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The Latest News of Liquid Air.

The Tripler Liquid Air Company, capital stock 1,000,000 shares, par value $10 each, is now widely advertising its stock for sale. The prospectus of the company says:

"The company has a factory in operation in New York city, where liquid air is being manufactured in commercial quantities, and it is being used daily in leading hospitals and for motive power."

We have certainly shown our disposition to keep the public informed concerning liquid air, and it would be a great pleasure to us to be able to tell our readers where and in what quantities and with what results liquid air from "Prof." Tripler's factory is used for motive power—but we have not the information. Does such information exist?

The most "practical" use of liquid air, according to the prospectus referred to, seems to be for refrigeration. Concerning this it says:

"As a simple instance, in the shipment of fruit from California, 55 gallons (500 pounds) of liquid air per car will do the work of 5 tons of ice, with dry air instead of moist air, and will save more than $130 per car in ice and its freight."

Now, allowing $20 for the cost of 5 tons of ice, which is too much, that would leave $110 as the saving of freight on the ice. It is to be remembered that the full supply of ice for the transcontinental trip is not put into the car at the start, there being supply stations along the road where the ice is replenished, so that probably not more than one ton of ice, and certainly never more than two tons of ice are carried, and the saving of this $110 is upon the freight of two tons of ice. The actual freight charge for carrying this two tons of ice must therefore be $110 plus whatever may be the cost of 500 pounds of liquid air. What does liquid air cost at the Tripler factory? At what price will "Prof." Tripler supply 500 pounds of liquid air, or any other given quantity, f. o. b., New York? These would not be impertinent questions for a prospective buyer of the stock of a liquid air company to ask.

Now, as to the transportation of liquid air, and its use as a refrigerant along the way, we must be permitted to express some doubts. As a matter of fact, has a single gallon of liquid air ever been carried from New York to San Francisco, or any equal distance? It is quite doubtful whether even so large a quantity as 55 gallons could be sent from the Atlantic to the Pacific, or *vice versa*, by fast freight and any portion of it survive to the end. The fruit train would require liquid air factories at intervals of twenty-four hours or so all along the route, and all the arrangements would be, even then, directed to the preservation of the liquid air rather than to the preservation of the fruit.

It is to be noted that none of the prospectuses of the liquid air companies are placed where they are aimed to attract the notice of mechanics, engineers, or any of the classes who have to do with precise information. The readers of the "American Machinist" are not buying liquid air stock, so that we have no need to call their attention to it. But that some are found to put their money into it is evident from what is spent in advertising it, and it is one of the marvels of the times that money can be drawn by wild promises and unauthenticated statements when honest and deserving and surely remunerative enterprises are neglected. Attention is called in this connection to the note in another column of Mr. Hudson Maxim.

Some Examples of Corporate Management.

It was quite apparent at the time to the practised eye that the work being done in changing the motive power of the Third Avenue road to electricity was, instead of being pushed, purposely delayed and held back. All along the trenches could be seen men working with hack saws in such a manner as to spend the utmost possible time on a given amount of work. A few deliberate strokes of the saw, made in some cases by a man on each end of it, necessitated a rest and several minutes' conversation between the hack sawyer and his helper, and it was clear that almost any one of the men employed on the work could have done his day's work in about one hour had he chosen or been allowed to do so. It now turns out that laziness among the men was not responsible for this, but rascality by those who controlled the road and the city government. They were making more money by throwing away the money of the stockholders in this manner than they would have made by pushing the work through to completion in the ordinary manner. The wrecking of the company and the appointment of a receiver for it are likely to bring to light such facts as might well make the stock-buying public hesitate to invest its money in any scheme for the development of public utilities.

The rights of stockholders are, however, often overlooked by those who control private corporations, as witness the operations of those officers of the H. C. Frick Coke Company who happened to have greater interests in the Carnegie Steel Company than in the coke company. They made a contract, or claimed to have made one, with the steel company that was ruinous to the coke company, simply because they themselves made more money out of the steel company by cheap coke than they would have made out of the coke company selling its product at the market price. That the minority stockholders were thus robbed seemed to make no difference whatever, and they probably would have had no remedy had not Carnegie and Frick fallen out about another matter.

Such operations are by too many re-

garded simply as "smart business operations." They are nothing more nor less than plain rascality and dishonesty. A better day for humanity will dawn when the fact is more generally recognized than it is now, and we have faith to believe that such a day will come.

Rights of Foreign Manufacturers in Germany.

Some time ago it was reported to us that the firm of Schuchardt & Schütte had sold in Belgium at least one horizontal boring machine, representing it to have been made by the Newark Machine Tool Company, when in fact it had been made in Chemnitz, Germany, in exact imitation of the Newark machine, though of an older type than is now made there. This charge is indignantly denied by the Berlin firm named, who take the position that even if the ethics of the matter are disregarded it ought to be evident to anyone that purely business considerations would prevent them from hazarding their business reputation and their standing with American tool builders by doing such a thing. Though urged to publish something upon the matter, we thought best to defer doing so until there was something more on which to base an article than mere denied assertion. It is, of course, obviously difficult, if not impossible, for Schuchardt & Schütte to prove positively that they have not made such a sale, and the burden of the proof must be upon those who make the charge to prove that such a sale has been made. And if such a sale has been made, it ought not to be very difficult to find the machine and the man who bought it, and to prove whether or not it was misrepresented to him, or whether it bears upon it the counterfeited name of the American maker. Our previous determination to wait until some such proof was forthcoming before commenting upon the matter is changed by the fact that the matter has been alluded to by a contemporary more anxious for news than to do exact justice, and we therefore print this statement of the facts as they appear to be at this time.

The incident has, at any rate, led Mr. Binsse, of the Newark Machine Tool Company, to make some investigation regarding what protection the German law affords to foreign manufacturers, and the following is a translation of a statement of the matter made for him by an eminent Berlin lawyer:

"By paragraph 37 of the *German Commercial Code,* anyone whose interests are adversely affected by the unwarranted taking of his firm name can require that this misuse shall stop and that damages be paid for the injury done to him. But this does not apply to the *mere designation* of goods by the firm name of another. On the other hand, more far reaching protection is granted by the statute of the German Empire (*Deutsches Reichsgesetz*) for the prevention of improper competition, 27th May, 1896, which provides in paragraph 8 as follows: Damages can be got from whomsoever makes use of the name of a firm or the private designation of a commercial industry in a manner calculated and intended to lead to its being mistaken for the name or designation properly used by another. In addition, the right to stop this misuse will be sustained. These rights, if not made good by legal action, expire six months after the period when information was first obtained of the act and of the person responsible for it.

"Besides the above, paragraphs 1 and 4 of the same statute bear on the case, as follows:

"An injunction can be obtained against anyone making statements which, as a matter of fact, are untrue, either in published notices or in communications intended for the general public, concerning business matters; more especially about the quality, the mode of manufacture, or the prices of goods or articles of trade, or the manner of obtaining the goods, or the sources whence they were had, or the possession of recommendations, or the reasons for or object of the sale, which statements are calculated to create an impression of a particularly favorable offer. This injunction can be had by anyone manufacturing the same or like goods or products or doing business in the same. In addition to the right to enjoin these false statements, the above named business men are entitled to make a claim for damages arising from the false statements upon whomsoever the responsibility for them rests, provided it can be shown that they were made knowingly. Pictorial representations or other arrangements calculated and likely to produce such false impressions are to be likewise considered as within the meaning of the provisions of sections 1 and 2.

"Paragraph 4.—Furthermore a conviction for an offense against paragraph 1 carries with it a fine not to exceed the amount of 1,500 marks.

"Those whose chief place of business is not in Germany have no rights in court under this statute, unless the country where they are situated gives like protection in similar cases to German interests.

"In addition to these means for protection, we have the fact that anyone selling goods made in Germany under the misrepresentation that they have been produced by a favorably known foreign firm is liable to a criminal prosecution if the deception has caused loss to the buyer. In any event, aside from this punishment, a claim can be made for damages under the *civil law.*"

What is here set forth applies, of course, to business done in Germany, and does not seem to apply to the case referred to above, or to similar cases wherein the goods are made in Germany, but are not sold there. For protection in such matters in Belgium, for instance, the Belgian law must, of course, be appealed to.

It will be noted that a manufacturer whose rights have been infringed in Germany must not sleep upon those rights, but must take action within six months of the time when he hears of the trespass and of the person responsible for it.

It will be noted also that German buyers are much better protected against imposition than they are in this country. Such a law as is quoted, if it were enforced here, would suppress very many of the so-called "bargain," "bankrupt," "misfit" and other sales which are invented for the purpose of fraud, and advertisements would in many cases have to be toned down to agree at least reasonably well with the facts concerning the goods offered.

There are very few of our readers who are not in some way more or less interested in drafting rooms, and we think, therefore, that most of them will carefully read Mr. Burlingame's description of the "drafting parlor" recently fitted up in the shops of the Brown & Sharpe Manufacturing Company. Mr. Burlingame is, of course, familiar with all the considerations that have received attention in scheming this department, and his article is authentic, complete, and in a certain sense official. It scarcely needs to be said that the arrangement and equipment of this drafting room have had careful study by men who know what a drafting room should be, and although facetiously referred to as a "drafting parlor," it will, we think, be found thoroughly utilitarian in all its features, and the more the floor plan is studied the more clearly it is seen that no pains have been spared to provide every possible facility for doing the work of the room well and economically.

We publish at another page of this issue an article by E. A. Parkhurst, of Hartford, who is one of the best-known mechanics and engineers of America, and whose work as an inventor and designer has been and is of very great importance in manufacturing operations. Mr. Parkhurst has always been interested in what others did before him and in the history of the development of machine tools. His present article relates to an early milling machine, and we are promised other articles giving some of the facts relating to the development of the turret screw machine, in which, as is well known, he himself took a very prominent part. We feel sure our readers will be glad to see these articles by a man so well informed in regard to mechanical matters and so thoroughly competent to discuss them.

A later article by Mr. Parkhurst will deal with the modern methods of rifle barrel manufacture and will be illustrated by drawings of many of the tools used, together with the machines, many of which were designed by Mr. Parkhurst himself. The manufacture of a modern small-bore, high-powered rifle barrel probably represents nearly the acme of present mechanical attainments.

Commercial Review.

NEW YORK, SATURDAY EVENING,
March 3, 1900.

MACHINISTS' SUPPLIES, ETC.

Two months are a long enough distance into the year 1900 to justify an answer to the question whether that year is sustaining the business reputation of 1899. The suppy trade answers with a distinct affirmative. Demand is excellent, the outlook encouraging. In some cases where January was found to be a little quiet relatively speaking, February brought a reawakening. Traveling men are now on the road, premonitions of spring trade are at hand, and March, which has the reputation of being the banner month for the first half of the year, enters auspiciously.

The extension of factory facilities and birth of new industrial enterprises which has characterized the last year or two has enlarged the field of the supply trade, and even assuming that the new plant boom had spent its force, a large demand for the accessories of manufacture might reasonably be felt. These are just the conditions noted yesterday from the point of view of a prominent local firm by whom both the principal and subsidiary lines of engineering wares are marketed. This house is selling a decreased number of engines and boilers to parties who are enlarging their shops, from which it is argued that industrial producing capacity has attained a level with demand. Supplies, however, are moving freely. The time to build plants has passed; the time to use them is still here.

Yet the market, taken throughout, shows plainly that the time for building plants has not passed. New enterprises are coming along almost, if not quite, as thickly as ever—some people venture to say more so. It is much to be doubted whether production ever does halt when it has overtaken consumption, or whether it does not keep right on until there is a large overproduction and the next panic ensues. This is one of the explanations that has been given for the slump and hard times of the middle nineties.

Fortunately, the country seems to be far away from overproduction as yet. Iron merchants predict that the year will continue to see rather a shortage than a surplus of pig. In the machinists' supply line, which is now more particularly under discussion here, gratifying complaints are still heard of the difficulty of getting goods from factory. The instances directly referred to were certain lines of twist drills and measuring instruments. Such difficulties, it is true, are at present exceptional, rather than general.

The machinists' strike in Chicago is causing trouble as far away as New York. The Webster Manufacturing Company's New York office has hourly been expecting news that the machinists and sheet-metal workers in their works at Chicago have gone out in sympathy with others in those trades. This would involve the majority of their 700 or 800 men, and their founders would not be of much use alone. The prospect is hindering the acceptance by the company of contracts for quick delivery, and is the more annoying from the fact that full facilities are only about half big enough to fill the orders that it is able to obtain.

The Northern Engineering Works, Detroit, Mich., have on hand a large number of orders for electric traveling cranes, including two 5-motor travelers, 65 feet span, for special steel plant work. They are also building a lot of electric jib cranes. They contemplate improvements and additions to their plant.

The Youngstown Rivet Company, of Youngstown, Ohio, is about to become incorporated with the title The Mahoning Manufacturing Company, with $100,000 capital, all of which is subscribed for. The company is about to make extensive improvements in its plant, which is exclusively devoted to the manufacture of boiler, ship and structural rivets, and is in the market for a milling machine, surface grinder, cold circular saw, drill press, 150 horse-power gas engine, conveyers, shafting and various special machinery.

The latest enterprise in the private commercial exhibition line, which seems to be becoming a popular way of doing business, is that of a new corporation, the International Land and Exhibition Company, capitalized at $500,000, which has taken 5,000 square feet of space on the ground floor of the Bowling Green Building, New York, for the display of machinery and mechanical wares. These will be shown in actual operation. Besides the exhibition department, several others are embraced by the plans of the company, among them export departments for different parts of the world. The company states that it is now representing for Europe manufacturers of machine tools and many other lines of machinery and appliances.

An engine manufacturer recently remarked that within his experience up to about two years ago the demand for engines would fall into a habit of running for a while on a particular size. For instance, at one time everybody would be wanting 20-inch engines, and then during another period the chief call would be for 12-inch. Of late this idiosyncrasy on the part of the trade has been abandoned, and engines of different sizes are selling indiscriminately. The explanation of these phenomena we leave for the learned.

A point was lately raised in the conversation of an engine manufacturer that "professional etiquette" among consulting and contracting engineers is getting to be too punctilious. It is said to be bad form under the present code for a builder of steam engines or the like to put in a bid with the engineer of a new plant unless he is particularly requested to do so. If he goes to the engineer and asks for opportunity to bid he is regarded as an intruder, and though both he and his bid may be politely received the latter is not taken seriously. Or if he tries to gain his object by influencing some stockholder in the enterprise over the head of the engineer he is likely to make an enemy of the latter. It is charged that the root of this matter frequently is that the engineers have their own favorite manufacturers and do not want anyone from outside in the way. Electrical engineers are worse sinners in this respect than mechanical, it is asserted, and architects are also guilty of the offense.

It is reported that the New York Air Brake Company contemplates the erection of factories for the construction of air brakes in France, Germany and Russia.

It is announced by the German Secretary of the Admiralty that if the naval increase bill is adopted the Stumm Brothers and the Krupp Works will receive orders for steel plates amounting jointly to $56,000,000. This, Herr Richter, the Radical leader, asserts, will give the manufacturers a clear profit of $36,000,000.

It would seem that late activity in engine manufacture and the resulting long deliveries are not confined to the United States. A member of the Sulzer Bros. engine manufacturing firm of Switzerland is or recently has been in this country, and is said to have stated that his concern is unable to accept orders for large work for delivery inside of a year. This firm, we believe, builds many large engines for electrical railway work, and has an extensive trade in Germany and Russia.

CINCINNATI REPORT.

If any other evidence of the importance of this center in the machine tool and wood-working machinery market were needed than the hurried additions under way at three-fourths of the establishments devoted to these lines, it can be found in the visits of prominent promotors, capitalists and men of affairs from extreme Southern and foreign cities who buy largely for their respective enterprises. During the week two prominent gentlemen—Roman J. Rodriguez and Gaspar Lynch—from Saltillo, Mexico, visited the city and purchased something like $25,000 worth of paper-making machinery and machine tools. The machinery was for the railroad shops of the Valhinla & Zacatecas Railway at Saltillo. Mr. Rodriguez, who is in the cotton and paper-mill business, purchased machinery designed for use in those industries; Mr. Lynch, who is the president of the railroad company named, made a purchase of something like $10,000 worth of machine tools from the Niles Tool Works at Hamilton. Both gentlemen remained in the city several days and bought of other Cincinnati concerns.

Secretary and Treasurer Murray Shipley, of the Lodge & Shipley Machine Tool Company, left on Thursday for a two-

weeks' trip in the South to investigate conditions. Mr. Shipley is very much impressed with the progress of the South, and will determine just what are the machine tool buying centers and what is their capacity. Mr. Shipley visited Richmond, Va., and Charlotte, N. C., first, and will work down along the coast, crossing over to New Orleans, thence into Texas and return home.

Among the more pronounced improvements made of late are those projected and already accomplished by the Cincinnati Milling Machine Company. This company has just completed another building—the fourth addition already made to the original plant. This company has also recently erected a separate office building, where have been put in operation some of the up-to-date industrial features. A dining hall, where meals are served to employees at actual cost, a lyceum hall and reading room, an extensive lavatory and system of shower baths constitute some of the important features. Money prizes are paid at regular intervals for the best suggestions offered for the improvement of the plant and its various products. Dividends are issued every quarter to all wage earners.

Secretary George F. Stewart, of the Bradford Machine Tool Company, is optimistic on business conditions. "We have been running over time for over a year now," said he, "and have orders six months ahead." Mr. Stewart notes that domestic trade is ahead of foreign, but that his company will make a handsome and adequate display in the Vincennes section at the Paris Exposition with four standard machines, which will be looked after by their Paris representatives. The Bradford people will establish a restaurant and other industrial features as soon as they can catch up on orders.

PITTSBURGH REPORT.

No decidedly new features are noticeable in the iron and steel trade for this district, although the mills are running to their full productive capacity and specifications for new work are coming in as regularly as desirable. Some large sales of Bessemer iron have been made during the past few weeks at prices ranging from $25 to $26 per ton, delivery to be made within three months. All the mills making finished material are running to their full productive capacity, and must continue to do so for some few months to come, as orders are coming in fairly well. There is not much buying in large lots beyond July delivery.

The foundry and machine concerns are kept going continuously, and the prospects are good. There is nothing special about any of the work, although some large-sized castings are being made. The outlook in the foundry trade appears good, so much so that several new concerns are being organized to enter the business. The Standard Automatic Gas Engine Company, Oil City, Pa., will break ground in the coming spring for a foundry to make their own gas engine castings. As yet no plans have been prepared for the plant. The Phillips Mine Supply Company, Pittsburgh, will erect a foundry as soon as a desirable site can be secured. The present plant is too small for the amount of business now being taken, and efforts to secure larger quarters are being made. The Pittsburgh Coal Company will erect a plant at Montour Junction, on the Pittsburgh & Lake Erie road, near Pittsburgh, for the manufacture of coal cars, coal mine equipment, etc. The plant will be modern in every respect, and will contain all appliances for easy handling of material.

The numerous rolling mills in this vicinity are generally undergoing some improvements. The Pittsburgh Sheet Manufacturing Company will add two more sheet mills to its plant at Shousetown, thus making it a four-mill plant. This concern was only started about a year ago, and is making rapid strides. The United States Wire and Nail Company, whose plant is located at Shousetown, is rapidly getting the works into condition to operate. Part of the machinery is being supplied by the Lewis Foundry and Machine Company, Pittsburgh. Reports are current that a new tube mill is to be located at McKeesport, and that Eastern capitalists are at the back of it.

CHICAGO MACHINERY MARKET.

Contracts for new plants let last fall should be now completed and pretty well out of the way. Buildings to be erected this coming spring are not yet under way. Theoretically speaking, therefore, the present time is between hay and grass for the electrical machinery makers. As a matter of fact, however, there have quite commonly been delays in the construction of new plants, from difficulty in procuring material and other causes, and installation of machinery that should have been made two months ago is now in progress, or yet awaiting the inclosure of buildings.

If there is any difference in the market conditions as compared with a month ago in this branch of manufacture, it is that the producers are in somewhat better shape to respond to calls for product. There is in sight a fairly large amount of business. It consists largely of electric railway work, the outlook for which was never more favorable nor satisfactory than at this time. For transmission of power purposes in manufacturing plants the situation is also one of uncommon activity. Prices are no stronger, and in exceptional cases are slightly lower than some figures which had previously been quoted. Generally the market is firm.

The Siemens & Halske Electric Company is now employing fifteen hundred men, and is operating many departments at night. More skilled labor would be employed could it be obtained for some electrical departments. The output of automobile motors is increasing rapidly.

The United States Cast Iron and Foundry Company has purchased for a plant at Birmingham, Ala., from the Sprague Electric Company a 400-kilowatt generator. The same electrical machinery maker has sold an electrical plant to the Baker Vawter Company, of Chicago, for installation at Nashville or Memphis; also motors for the press rooms of the Kansas City Times and the St. Paul Dispatch.

Among recent Western orders taken by the Crocker-Wheeler Company were the following: An 850-kilowatt generator and motors for the Anglo-American Provision Company, of this city; a 100-kilowatt generator for the D. N. Mansur Company, Moline, Ill., with motors; two 125-kilowatt generators for Park, Davis & Co., manufacturing chemists, Detroit, Mich.; two 200-kilowatt generators and 400 horsepower motors for the St. Louis Cold Storage and Refrigerating Company; a 500-kilowatt generator for the Dow Chemical Company, Midland, Mich., for electroplating purposes; besides a number of smaller orders.

Trade seems to be equally good for large and small power machines alike for shop use. There are several large plants figuring on electrical equipment, and the small concerns looking into this form of equipment are quite numerous.

Quotations.

NEW YORK, Monday, March 5, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$23 70 @ $24 20
No. 2 X foundry	22 70 @ 23 20
No. 2 Plain	21 70 @ 22 20
Alabama Irons:	
No. 1 foundry	22 25 @ 22 75
No. 2 foundry	21 25 @ 21 75
No. 3 foundry	20 25 @ 20 75
No. 1 soft	22 25 @ 22 75
No. 2 soft	21 25 @ 21 75
Foundry forge	19 75 @ 20 25

Bar Iron — Base sizes — Refined, mill price on dock, 2.20 @ 2.30c.; store price, 2.50 @ 2.60c.; common from store, 2.45 @ 2.50c.

Tool Steel—Base sizes—Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, 2.85 @ 3c.

Cold Rolled Steel Shafting—Base sizes—From store, 4 @ 4.20c.

Copper—Lake Superior Ingot, 16½c., electrolytic, 16¼ @ 16½c.; casting copper, 16¼c.

Pig Lead—Wholesale lots, 4.70c., New York delivery; carloads, 4.72½ @ 4.75c.

Pig Tin—In 5 and 10-ton lots, f. o. b., New York, 34½ @ 35c.

Spelter—Prime Western, 4.60 @ 4.70c., New York delivery.

Antimony—Cookson's, 10.90 @ 11.00c.; Hallett's, 9¾c.

Lard Oil—Prime City, present make, 50 @ 54c., according to brand and quantity, in jobbing lots.

One of the Earliest Milling Machines.

BY E. G. PARKHURST.

To Dr. Hook (an Englishman) is attributed the invention of the rotary cutter, said to have been during the year 1664. What method the doctor had, or how his machine was constructed, is to us unknown. Of this we are certain—his system did not at that time come into general use. My purpose in this paper is to describe a milling machine which was devised, built and successfully operated in 1818. Therefore, it is but reasonably fair to suppose it was one of the first ever put at work in New England. The reader will, I trust, pardon me if I digress by giving a little history before relating the facts concerning the machine.

During the year 1814 Mr. Robert Johnson and other English gunmakers came to the United States and settled in Middletown, Conn., where they built a factory on a mill site known then, as now, by the name of Mill Hollow. There they commenced manufacturing military firearms. In 1827 they rebuilt this armory, which to this day is being used for manufacturing purposes. At the time of which I write the manufacture of small arms (muskets, pistols and swords) was one of the larger products of the town, there being three gunmaking establishments there. Therefore, it may be noted, Middletown for years was headquarters for skilled mechanics, and there must have been among the many mechanics those possessed of mother invention. Later, I propose to try to prove that other labor-saving machinery originated at some of the aforesaid armories.

It should be borne in mind we are speaking of days when the file was the principal tool in use for shaping, fitting and finishing gun parts. A day's labor at filing and fitting was set by a stent-master, an expert; for instance, four lock plates were fixed for the day's work of fourteen or fifteen hours. If the workman filed five the extra one was put out of sight, and the time soldiered out the next day. This is no fiction, as I had such statements from an old stent-master, whose veracity was unimpeachable.

It was in the latter part of 1851 that the facts herein stated came to my notice, through a conversation with Mr. Robert Johnson, who called my attention to the machine in question, and said it was the first he had ever known of. He gave the year in which it was first put to work as 1818, though he did not claim it as his own invention. He further stated that the machine was used for several years before the automatic or power feed was added. As I understood him, it had no regular attendant; each man used it as his need required in taking small flat cuts. There was no evidence to show that the machine was ever used on curved or irregular cuts, as the cutter I saw in the machine was a plain one, about 1½ inches in diameter and 1 inch face; the teeth in this cutter were filed out. Mr. Johnson also stated that at first the workmen did not take to the machine—considering it an innovation on filing, though later they used it to save hand labor in taking a roughing cut that would leave a surface flat.

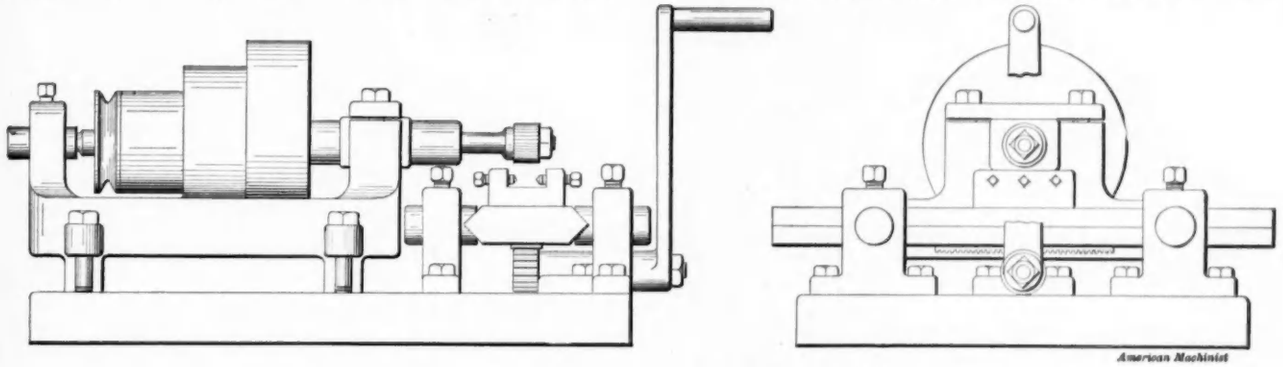
Inasmuch as there is but a single principle involved—that of a moving table underneath a rotary cutter—slight description is required. The accompanying drawing shows all there was in the machine, except the self-acting feed, and as stated elsewhere, it was several years before that portion of the mechanism was added.

Bolted to a wooden bench by four bolts was a base or bed-plate of rough cast iron about 18x24 inches, 2 inches thick. There was a head, which had been removed from an engine lathe. Fitted to this was a spindle with a square taper socket, having one journal box and a rear step bearing. There were wood cone pulleys about 2½ inches face, the largest about 8 inches in diameter; the grooved pulley for feed was added later. On the bed, at about 12x6¾ inches center distances, were bolted, with two bolts each, four upright stands about 4 inches in hight, and these were bored near the top to receive four round plugs that were secured by setscrews from the top of the stands. The plugs were about 1½ inches in diameter, and had cut in the inner ends V notches about 90 degrees angle, in which were supported the angle-edged table, about 20x5 inches, 1½ inches thick. On the under side of the table was, fastened by screws, a cast-iron (cast-tooth) rack, about 1⅛ inches face and 6 inches long. The cast-tooth pinion, about 1¾ inches in diameter, was made fast to a shaft which had on its outer edge that projected over the bed a hand crank (about 10-inch centers), the same secured by square eye and nut. A stand bolted to the bed with two bolts supported the pinion shaft at such hight as secured the proper mesh of pinion and rack.

The fixture for holding parts to be milled was made in the form of a trough, and had pointed setscrews at each side. There was no adjustment whatever in the machine, other than that at the side of the table to compensate for wear. Strips of metal or paper were used to pack under a piece should a recut be required.

Thus a primitive milling machine was constructed, and there is good evidence to show that it was contrived and put at work about eighty-two years ago. It is some forty-eight years since I saw it, and I have endeavored to show its principle, rather than the exact pattern. My regret is that the machine did not find a resting place in some museum, instead of being consigned to a furnace cupola.

Hartford, Conn.

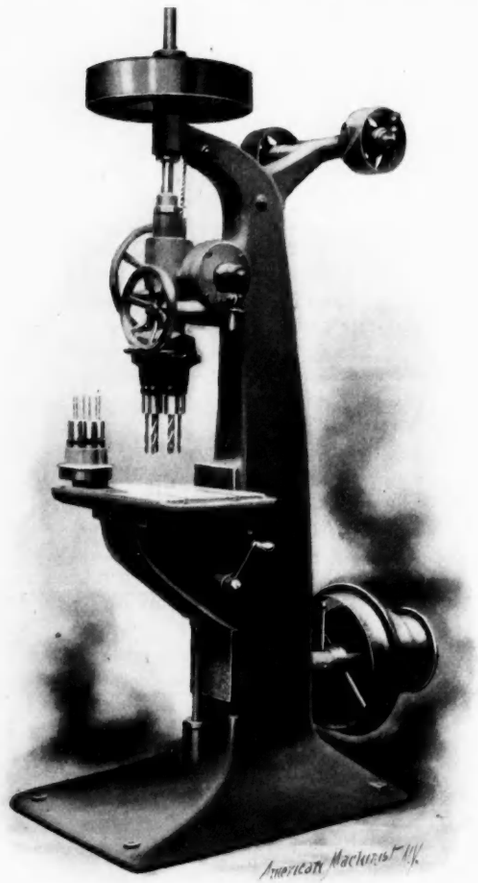


PRIMITIVE HAND MILLING MACHINE, MADE IN 1818.

An Electric Gun.

A reader sends us a clipping from a New Orleans paper, containing an illustrated account of an electric gun invented by L. S. Gardner, of that city. The gun consists of a cylinder open at both ends and surrounded by a sectional solenoidal coil. By means of a commutating switch, coils in front of the projectile are cut in, and those in the rear cut out, as the projectile moves along the cylinder. The inventor, and probably others, have apparently concluded from the working of a small model, using beheaded wire nails as projectiles, that this form of gun will supersede the forms now in use. Our faith in this is not very strong, because we can conceive of no way by which the required energy to bring a heavy shot up to 2,000 foot seconds velocity within a small fraction of a second can be developed or applied to the shot. In our issue of May 5, 1898, we pointed out that a

shot from a 13-inch naval gun has at the moment of discharge 68,407,960 foot pounds of energy stored in it. Assuming that the shot is discharged from the muzzle in one-tenth of a second after ignition of the charge, it is clear that energy must be developed and applied during that time at the rate of about one and one-quarter millions of horse-power. We do not believe that our present knowledge of electricity will enable us to come anywhere near developing energy at that rate and applying it to a shot within a gun.



NEW LANGLIER DRILLER WITH INTERCHANGEABLE HEADS.

A New Driller.

The Langelier Manufacturing Company, of Providence, R. I., has recently brought out a new drilling machine which is intended especially for manufacturers' use and which is shown by the accompanying engravings.

The main vertical spindle is driven by the belt direct, which belt runs at relatively high speed on account of the liberal dimensions of the pulleys. The spindle sleeve is enlarged at the bottom and provided with means for receiving and holding in place any one of any required number of heads; these heads having the spindles which do the drilling. A section of one of these heads is shown herewith, and by this it is seen that the spindles are driven by means of small cranks, which engage with a crank plate that is moved by a crank pin on the end of the main spindle. The cranks and plate are counterbalanced in the manner indicated by the drawing so that the spindles can be run at high speed without vibration. The machine is, of course, intended only for such work as calls for the drilling of a large number of pieces, all alike, in one lot, and where it will pay to make the necessary fixture and the head adapted for the job. After that the work of setting up for any given job consists simply in slipping the head into its place and clamping it, after which the drilling is done very rapidly.

Judgment in the Use of Cores.

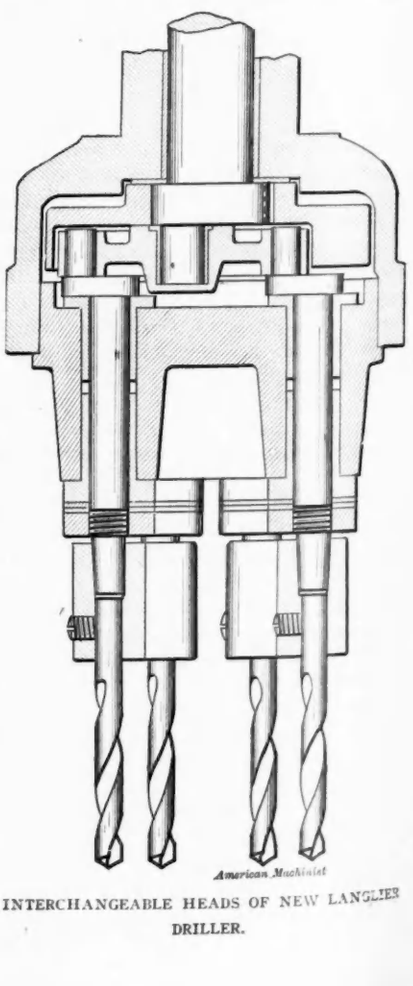
BY R. H. PALMER.

The vexing question often arises in the foundry as to whose fault it is that a cored casting is poor. Often the molder says, "It's the coremaker's fault!' "There's too much flour in the core mixture." "The core's as hard as a brick!" The gas don't escape, or it was not ventilated aright, or not pasted properly, or there is something the poor coremaker is to blame for, and he (the molder) is in no way responsible. It's that other fellow every time. Now, in many cases the above is true. Many foundries have a man in their core-room who mixes all of the sand made into cores, and they find that it pays better to do so than to allow each coremaker to mix his own sand. Under this system, when a coremaker is given a box he is told to make the core from a mixture in such a bin. The man doing the mixing has his measure to measure sand and flour, and has no excuse for not doing as he is told, while the coremaker does not have a chance to guess at the mixture, because the measure is not handy.

One of the things that mean a great deal to the molder in saving time is to have his cores ready for him to set as he closes up his molds—that is, when it is possible to set cores at that time. In snap work of course it is a necessity.

But I refer now to tight flasks and side floor work. We will suppose the cores are ready. Sometimes a man has a job where if he could set the core when he finished the mold, it would save an extra lift; but the question comes up—will not the core get damp and blow?

If a core is some 10 inches between prints and, say, 5/8 inch diameter, and is made of flour and sand, it will stand the iron rising around it if it is not left in the mold too long before pouring, and if the core stands upright; but a molder would expect to have a rod in it if he were to set it in the morning and leave it all day; and if the iron were to enter the mold in



INTERCHANGEABLE HEADS OF NEW LANGLIER DRILLER.

such a way as to flow partly against the core, a rod would be necessary anyway.

Now, were the same size core to be set lying on its side, a rod would be necessary to strengthen it to stand the upward pressure of the iron flowing under while pouring, and the more the strain the stouter the rod. If the core is set too soon in the mold, and especially if a little warm, it will collect the dampness, and will become very soft. I have seen men go into a core-room, pick up a core and try to bend it, and remark: "That's stiff enough; that won't spring." Yet, taking the same core and leaving it in the mold a little too long before pouring, so that it gets damp, it looses its rigidity, and springs. When dry, the mixture of flour and sand around the rod makes a core with even a light wire in it very stiff, backing up, as it were, the wire; but when damp, and not so damp that it will blow to spoil a casting (as far as any kick from it comes), the core will be sprung and the hole crooked.

Are there not many castings lost by cores being set in the mold too early in the day, and thus getting too damp?

Once I had quite a number of castings to make off a pattern requiring a core some 9 inches long, some 7-16 inch opening, and, after entering the casting, some ¾ inch at each end, swelling out to form a chamber, and the casting was cast with the core lying down. I gave the corebox to the coremaker, with instructions to make so many per day, and to the molder the pattern, with "Make, say, eight flasks a day. Look out you don't set the cores too early." The first day's castings were all right; the second day's were blown. On seeing the coremaker he said, "The first day they were ready, and set just before the wind went on. The second, they were ready the first thing, and the molder took them." Seeing the molder: Yes, he set them just before the wind went on the first day, and the second he set in the morning the first thing, and he had them up now with the cores in. I told him: "Let them set." In a short time he came to me with "They tell me the cores are blown in those castings; I told that fellow he was putting too much flour in, and I don't believe those vents were clear. I know one or two were poor. I have them in extra to-day." I merely said, "Very well, let them set." Just before the wind went on I went to this man, and had him lift the copes. The cores were so damp from the mold, they were ready to fall to pieces. Setting fresh cores, they were poured during the heat, and the castings were all right.

Because you can set a core standing on end, and have it stand the pouring all right, it does not follow that the same rule applies to cores lying down; and because you can set a core lying on its side in the morning that is 2 inches in diameter, it does not follow that you can set one ⅝ inch diameter at the same time. Rosin cores will stand in some ways more than flour, and small cores made with oil and baked well will stand dampness.

That it's the cores and the poor fellow's carelessness we know many times, but it's the poor fellow's carelessness who sets the cores that the poor fellow in the coreroom is often blamed for.

Sometimes it costs to find out some little points. Some years ago I was making some castings, two in a flask, requiring cores some 14 inches long, 3-16 inch on the small end, 7-16 inch diameter on the large, ranging from that up to 24 inches long, ⅜ inch small, ⅝ inch large end, and using 120 to 160 cores a day. After molding all up, the copes were removed and the cores set. Grasping a handful in my left hand, I would straddle the row of flasks, and picking one up by my right hand, glance along it to see if it was straight and the vent clear. If it was crooked I set the rounding side down. If it was straight I bent it, as it could be done on the smaller sizes, and the upward pressure of the iron straightened the core. I left these. Meeting the foreman of that shop one day on the street, he asked: "How was it you never had trouble with those cores? Every once in a while we have some crooked core-holes, but still the cores are good and straight. I looked them over several times." I said, "Why, my dear sir, I never set a straight core in all the thousands I used." "What? Well, I must be going." He caught on.

Again, if dull iron was used and the iron forced in, it would spring the cores. (The castings were bolsters for a speeder frame, or I think in cotton machinery they are called slubbers.) But with sharp iron poured in gently, giving a chance for it to flow easily, there was no trouble in coming dirty or cores springing.

A roll some 7 feet long, 5 inches diameter, with openings some 1⅛ inches on the end, gave some trouble by the core springing. Chaplets could not be used; the roll was not more than 7-16 inch thick, as I remember; but by gating it the full length on both sides, and pouring with some eight hand ladles, four on each side, so that the iron quickly filled the mold, there was no trouble.

Many times, where possible, it will be found very beneficial if one end of a flask which contains a mold with a long and comparatively slender core in it can be raised while pouring. In this way the strain is lessened, as the iron does not flow up under the core the whole length at one time. And many times if the iron is allowed to flow gently in starting with a certain sized stream, and keeping it that size, the casting will come out clean; but if a small stream is started, and then, after pouring a short time, the stream is increased, it is like the river, throwing driftwood ashore by the nomal current; but by a freshet it is whirled into the stream again, and lands perhaps in the wrong place, and it is so with stodge.

The New Drafting Room of the Brown & Sharpe Manufacturing Company.

BY THE CHIEF DRAFTSMAN OF THE B. & S. MFG. CO.

When the subject of a new drafting room is under discussion the first question arising is, Where shall it be located? Perhaps the most usual arrangement is to connect it with the business offices, the arguments for this being that such offices are sufficiently separated from the workshops to insure freedom from noise, vibration, dirt, etc. This grouping also connects the designing and administrative departments. If a separate building is used for such offices the architecture and conveniences are easily arranged to be suitable for a drafting room, the usual plan being to place the drafting room over the offices. It would seem, however, more important to locate the drafting department near the center of the group of buildings used as machine shops, even when by so doing it separates it from the business offices. Such a central location makes it accessible to the workmen from every part of the establishment, an important feature in a well conducted shop, where drawings are carefully followed, and when any point in doubt must be talked over and made clear. Besides, many of the draftsmen, to properly carry on their work, must be often in the shop, looking up points, taking measurements and in consultation with the workmen.

At the Brown & Sharpe Manufacturing Company it has been considered important that the drafting department be in close touch with the foremen and workmen. The "American Machinist" has from time to time published some of the methods by which this spirit is encouraged and cultivated at these works to the mutual benefit of all concerned. The fact that the new drafting room is located in accordance with these principles is another indorsement of such a policy. It occupies the third floor of a central wing of the main building, and is convenient to the passenger elevator, which gives ready access to all of the five floors of the building.

It might be said here incidentally that if managers realized what a convenience and saving resulted from the use of such elevators in manufacturing buildings of several stories' hight they would be much more the rule than the rare exception.

In connection with the drafting room are separate offices for designers, mechanical engineers and those in charge of the various engineering departments of the works. These are separated by glass partitions about 8 feet high. They open into a central passageway, at the end of which is a counter where much of the business between the drafting department and the shop can be done.

Convenient wardrobes, together with a wash room and closets are provided. The stairway, shown in the plan, gives access

to the blueprint room above. On a landing half way up this flight of stairs is a series of storage closets for spare boards, supplies, etc.

There is a special room for photographing machinery just outside the main drafting room and connected with a freight elevator at the west end of the building. This room is arranged with skylights, screens and curtains to control the light. This makes it possible to photograph the machines under favorable conditions, instead of, as formerly, in any corner of the shop where space could be cleared. The developing room and closet for cameras are adjoining this room. The blueprint room is on the roof, reached by the stairway previously mentioned.

After considering the location and general arrangement, the next questions arising are those of lighting, heating and ventilating. Being on the top floor of the wing and the room being too wide to light properly from side windows only, overhead lights have been provided in addition to the side windows. These skylights, fourteen in number, are of saw-toothed construction, facing to the north. The light is diffused and softened by the color effect of the walls and ceiling. Dark green window shades control the light. These shades are mounted in special fixtures, and work up and down from the middle of the window, thus regulating the light and allowing for ventilation through the windows without injury to the shades.

Artificial lighting is by incandescent electric lights. The various systems of arc lighting were discussed, but the construction of the ceiling, with skylights, is such that it was not thought best to use any of them. The incandescent lamps in use are on rods adjustable in all directions; there are two lights for each draftsman, besides a general system of lighting.

With the hours of work as they are in the Brown & Sharpe drafting department, artificial lights are required during only a few months of the year. The foot of the socket carrying the rod just mentioned is so arranged that the complete fixture can be readily removed and stored during most of the year.

To properly heat the rooms a steam radiator is placed under each window. In addition to this outside air is forced into the room, giving a constant supply of fresh air, warm in winter and cool in summer. Our superintendent aptly says that the air reminds him of Florida every time he goes through the room, it is so fresh and balmy.

The drawings are filed where they will be in a central location, convenient alike to the clerks and draftsmen. They are found by a card index system. The cases extending lengthwise of the room contain packages of drawings not referred to as often as the regularly indexed drawings, and in each drawing table is a cabinet of slides for storage, using space that would otherwise be wasted. There are also cases of drawers provided for trade catalogs and patents, card indexes being used as finding lists.

The six drawers of index cards are arranged to run on rolls. This is an important feature, as these drawers are constantly in use and, being heavy with so many cards, would otherwise work hard and wear down in the guides.

Clamps are provided in each drawer to hold the drawings at the front, so that many more than would otherwise be possible can be filed without danger of the edges catching when opening the drawer. The sketch shows this; also a protecting strip at the back of the drawer to prevent the drawings working over the back.

The clerks' headquarters, back of the counter previously mentioned, might be called the business office of the department. Here are located the telephone connecting to all parts of the works, call bells to the blueprinting, photographing and other departments, and a call by signals for such men as are working in the room and are frequently needed in consultation with the foreman or at the counter. The foreman's desk and dumb waiter are also provided with call bells. These materially aid in carrying on the work promptly and economically.

In the cases of drawers connected with

VIEW OF BROWN & SHARPE MANUFACTURING COMPANY'S DRAFTING ROOM, TAKEN FROM NEAR THE CHIEF DRAFTSMAN'S DESK.

the clerks' headquarters are stored such diagrams, shipping lists, index and feed tables, blueprints, etc., as are sent out to customers. In addition to these the photographs are kept here, several thousand being constantly carried in stock. These are classified so as to be quickly found for delivery, and the stock is kept up in a systematic way.

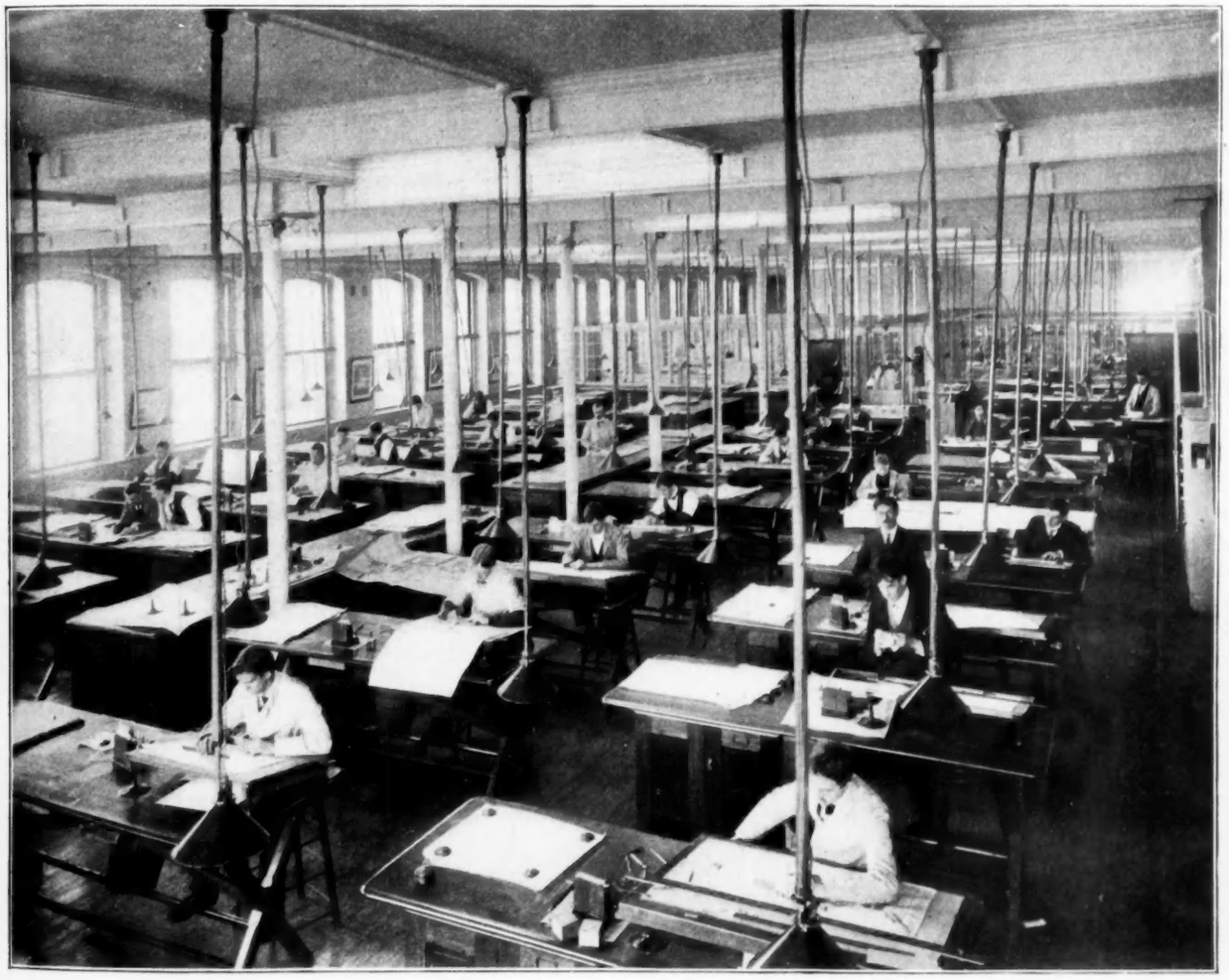
A novel card index is used to keep track of the photographic negatives. The cards are of one size, large enough to mount a blueprint of an 8x10 negative. Space is left at the top for a printed heading, where the name, date and index number are entered. The cards are arranged alphabetically, and it can be seen at a glance by the help of the picture on the card whether the right one of several similar ones is chosen.

All records of pattern changes, shop notes suggesting changes, and complete written records of all changes made on drawings of standard machines are filed in this case of drawers. Here also is kept the charging record accounting for all drawings and blueprints sent out of the room.

The foreman's office is furnished with a desk and a drawing table. This table is so placed as to be convenient to use also as a consultation table. On the other side of this inclosure is a bookcase and a case for bound volumes of the "American Machinist" and other technical papers.

A paper rack is provided carrying three rolls of paper of the kinds commonly used, although this is for exceptional cases only, as paper is provided of all kinds cut to standard sizes.

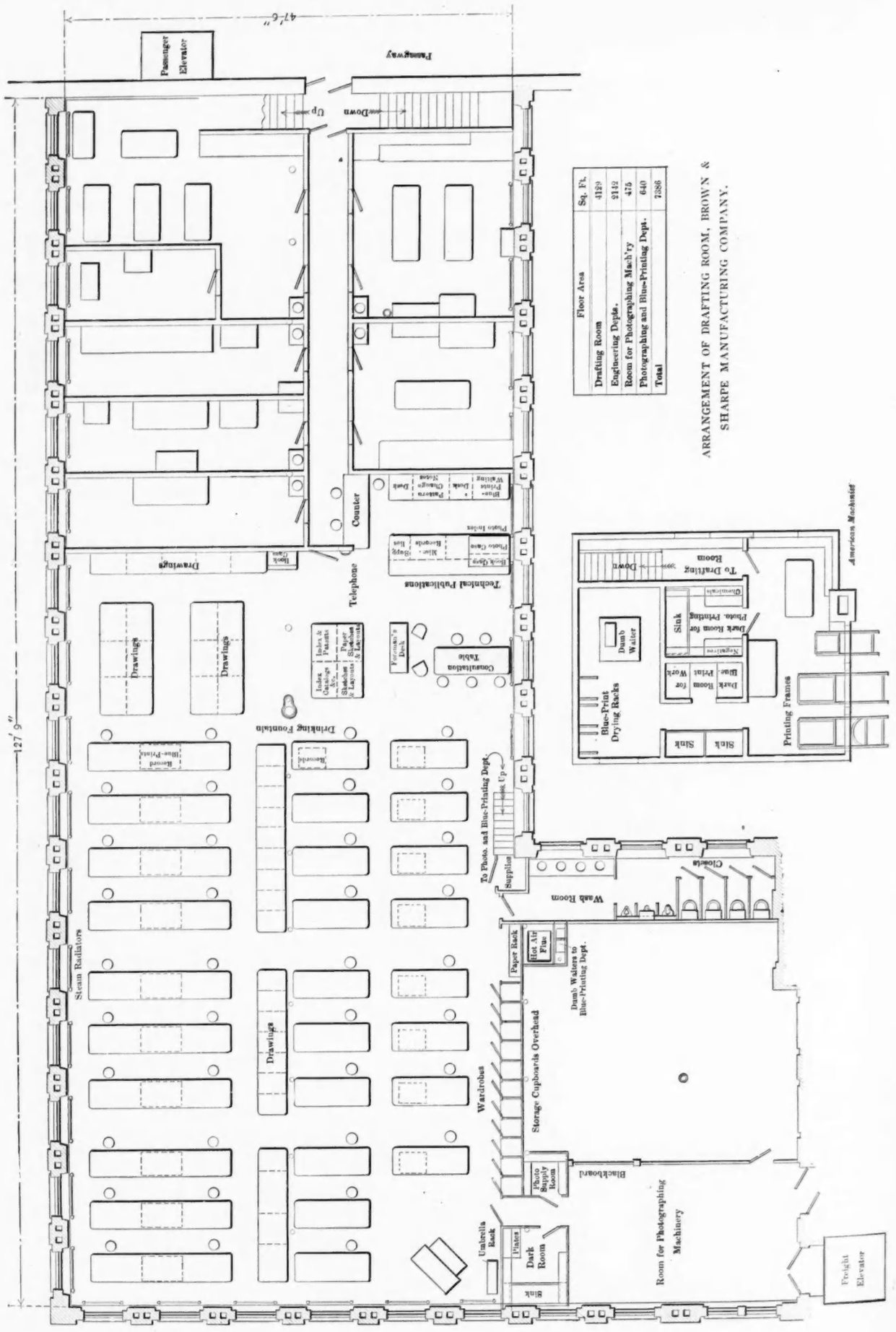
The drawing tables are of two sizes—3x8 feet and 3x16 feet. The former are planned for one man at a table; the latter for two. This arrangement gives ample space for reference drawings without their being creased or folded, a trouble found to be serious in the old cramped quarters. There are accommodations for fifty draftsmen without crowding. Each man is provided with a tool drawer, a drawer to lock and a deep drawer suitable for reference books, notes, etc. Board supports are provided of different hights to tilt the drawing boards to a convenient angle. Parallel ruler drawing boards are used. Each table is furnished with an ink stand containing four colors of ink. This is combined with a memorandum paper rack, holding three sizes of paper. A slanting bottom in these racks makes the edge of each sheet of paper stand above the one back of it, making it easy to remove a sheet without disturbing the others. On each table is also a book of reference tables and instructions, made up of photographic reductions of the original drawings and tables. This gives the draftsman about sixty pages of such information as is most often wanted in compact form and always at hand. A brush and a file for sharpening pencils complete the equipment of the table.



VIEW OF BROWN & SHARPE MANUFACTURING COMPANY'S DRAFTING ROOM, LOOKING TOWARD ENGINEERS' ROOMS AND CHIEF'S DESK.

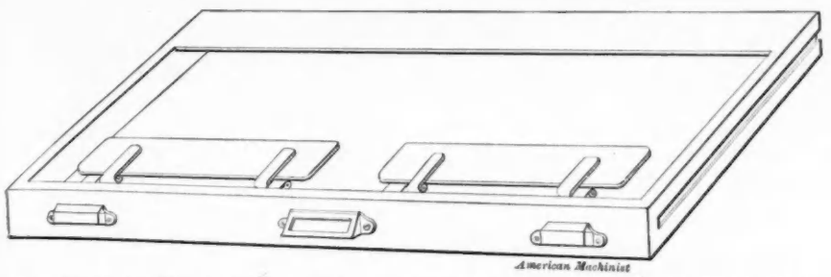
An upright board is in the corner of the room, convenient for laying out large work. An 8-foot reversible blackboard is built into the partition in the photograph room, allowing for laying out work full size to get the general proportions.

The blueprinting room has large windows, such that full sized prints can be made inside the room in stormy weather, by swinging the frames up to the window panes and using quick printing paper. Swiveling blueprint frames are used, which can be revolved in two planes to face the sun. The blueprint washing tank is double, and is made of soapstone. It is in a semi-dark passage connecting with



ARRANGEMENT OF DRAFTING ROOM, BROWN & SHARPE MANUFACTURING COMPANY.

Floor Area	Sq. Ft.
Drafting Room	4129
Engineering Depts.	2132
Room for Photographing Mach'ry	475
Photographing and Blue-Printing Dept.	640
Total	7386



SKETCH OF DRAWER, BROWN & SHARPE MANUFACTURING COMPANY'S DRAFTING ROOM.

the drying room, where frames are provided for drying the blueprints. Steam pipes and circulating air are used to aid in the drying process when necessary. On the other side of the passage is a dark room for cutting and handling the sensitized paper. The dumb waiter already mentioned connects from the drying room to the drafting room below. Photograph printing is also done in this department. Windows are arranged purposely for sun printing, and the dark room for developing and washing prints is provided with a shutter opening to the light for printing on the special sensitized papers which we now use almost entirely. The negatives are kept in suitable racks in this room. Electric lights are located wherever required, and there is a thorough system of ventilation for all dark rooms, so constructed as to keep out the light.

No fireproof vaults are provided for drawings, as the buildings are practically fireproof. As a precautionary measure, however, sets of blueprints of all standard machines are stored in a distant part of the works.

Throughout the whole equipment of the department the Brown & Sharpe Company has worked on the principle of doing everything possible to add to the comfort and convenience of the men, and to facilitate the carrying on of the work. Nor is this all; the matter of appearance has had careful attention in every detail, so that from the delicately colored ceiling with its ivory-tinted casings and beautiful clusters of frosted electric lights to the walls ornamented with framed diplomas and photographs, with a fine gallery clock in plain view of all, down to the highly finished wainscoting, the tables, the very floor itself, all show a high degree of artistic effect. The workmen jokingly speak of this room as Brown & Sharpe's new drafting parlors; but, joking aside, such surroundings must tend to elevate all that are brought within their influence.

If the expressions of appreciation from the many visitors that have so far seen this new department are any criterion, the Brown & Sharpe Company has a drafting room of which they may well be proud.

L. D. BURLINGAME.

Hark, hark, the dogs do bark,
The autos in line are seen!
Some with wires, and some with steam,
And some with gasoline.

—"Cleveland Plain Dealer."

Switchboard Instruments—Ammeters and Voltmeters—I.

BY WM. BAXTER, JR.

Instruments used to measure the strength or voltage of an electric current can be constructed in many ways, but in every case the accuracy of the indications depends upon the proper proportioning of the several parts, so that the movement of the indicating hand may be in true accordance with the variations in current or pressure, according to which the instrument is designed to measure. An instrument that indicates the strength of the current is called an ammeter, and one that indicates the voltage is called a voltmeter. In principle of construction, there is no difference between the two, but in their connection with the circuit wires there is. An ammeter is so connected that the whole current passes through its coil, while a voltmeter is connected so that the total voltage acts to force a current through its coils. The current that passes through an ammeter may run up into the thousands of amperes, unless it is arranged to operate in shunt, as will be explained hereafter; but the current that passes through a voltmeter is only a small fraction of an ampere.

The diagrams, Figs. 1 to 11, illustrate the principles upon which nearly all the ammeters and voltmeters in actual use are constructed. In Fig. 1 *M* represents an electromagnet which is energized by the coil C. If the instrument is intended to be an ammeter, this coil will consist of only a few turns of wire of large size, the number being reduced as low as one if the current to be measured runs up to a thousand or more amperes. If the instrument is to be a voltmeter, the coil will be made

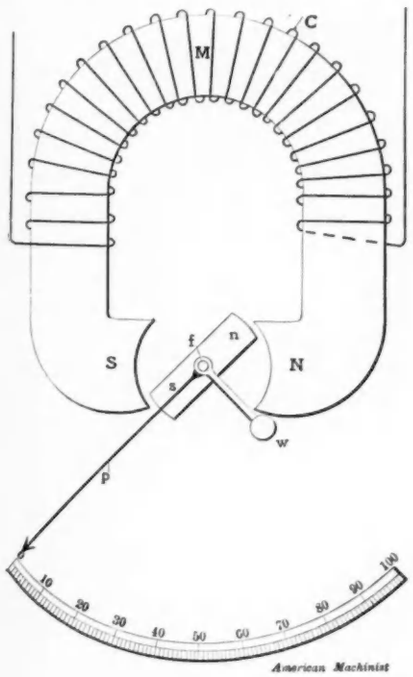


Fig. 1

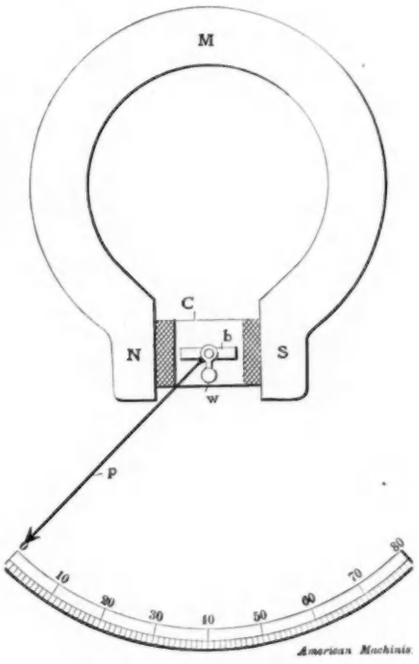


Fig. 2

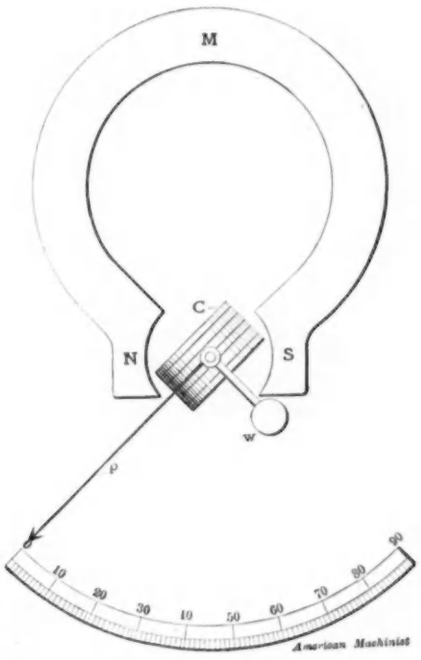


Fig. 3

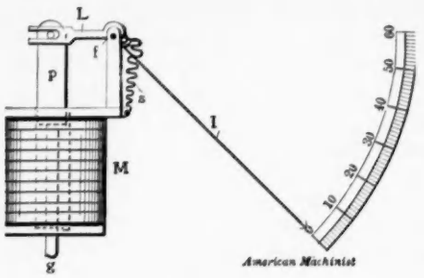


Fig. 4

of several thousand turns of very fine wire.

The bar *n s* is a permanent steel magnet, and it is arranged to rotate upon the stud *f*. The pointer *p* and a weight *w* are attached in any suitable way to *n s*. If the current that passes through the coil *C* is in such a direction as to develop *N* and *S* poles as shown, then there will be a repulsive force set up between these and the poles *n s* of the small magnet. This repulsion will rotate *n s* in a direction opposite to that of the hands of a clock, and thus the pointer *p* will be moved over the scale. As *n s* rotates, it has to lift the weight *w*, and as the moment of this about the center *f* increases as *n s* turns toward the vertical line, it is evident that the position to which *p* will be moved will depend upon the magnitude of the repulsive force exerted by *N S* upon *n s*. Thus it will be seen that the greater this force, the further around toward the right will the pointer *p* be deflected. If all the parts are properly proportioned the deflection of the pointer may be made to agree with the increase in current strength required to produce the deflection.

Fig. 2 illustrates another way in which the movement of the pointer can be effected. In this construction, *M* is a permanent steel magnet, and *C* is a coil of wire through which passes the current that is to be measured. A small bar of iron *b* is mounted upon a stud situated in the center of this coil. The weight *w* acts to keep the small bar in the horizontal position. The magnetic attraction of the poles *N S* of the magnet *M* also acts to hold *b* in the horizontal position, and in fact is the principal force that holds it there. The current that passes through the coil *C* exerts a force that tends to turn *b* around into the vertical position. This force is resisted by the weight *w* and the attraction of the large magnet. The small bar, therefore, is under the control of two forces that act at right angles to each other, and the position to which *p* will be deflected will be dependent upon the relative strength of these two forces. The force exerted by *C* increases as the current strength increases, therefore, by properly proportioning the parts, we have a means of causing *p* to move over the scale at a rate directly in proportion to the strength of the current passing through *C*.

In Fig. 3 the coil *C* of the last figure is made so as to revolve around the central stud, and the small bar *b* is removed. In this case, when a current passes through the coil, an attractive force is developed which tends to rotate *c* into a position with its axis horizontal. The weight *w* resists this movement, and as its moment around the center stud increases with the advance of *p*, it follows that to increase the deflection of the latter, the force acting between the magnet *M* and the coil *c* must be increased. In Figs. 1 and 3 the principle of action is essentially the same—that is, it is due to the repulsion and attraction of one magnet toward another. The coil of the last figure is just as much of a magnet as the steel bar of Fig. 1, it being what is called a solenoid magnet. In the first figure, the pole *n* of the small permanent magnet is pushed away by pole *N* of the electromagnet *M* and it is also attracted

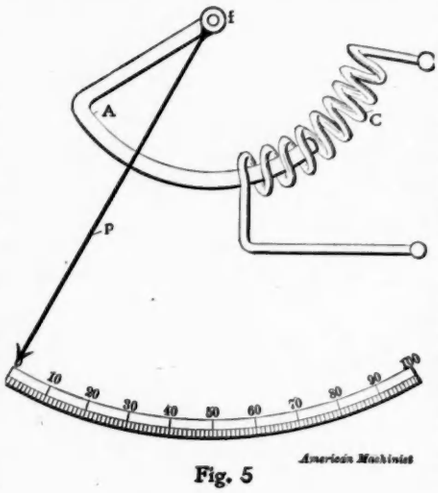


Fig. 5

by the pole *S*. In Fig. 3 the upper end of the coil c is attracted by pole *N* and is repelled by *S*.

In Fig. 4 *M* is a solenoid magnet, and *p* is an iron core. When a current passes through *M* the core is drawn downward, and the force exerted upon it is increased by increase in the strength of the current. When *p* moves downward, it carries *L* with it, the latter swinging around the pivot *f*. The spring *s* counteracts the pulling force of *M*, hence the position to which *l* is deflected depends upon the relative magnitude of the forces exerted by *M* and *s*. In this figure it will be noticed that the pull of the magnet is resisted by the tension of a spring, while in the other diagrams, gravity is depended upon. It will be understood, however, that in any of these arrangements the resisting force can be either a weight or a spring.

Fig. 5 is a modification of Fig. 4 in which the plunger as well as the solenoid is made in circular form, and thereby the sliding contact between the lever and the plunger is avoided. The principle of action is the same in both cases—that is, the magnetism developed by the current passing through the coil draws the iron core into it. In the last figure, the pointer *p* and the core *A* are so set that the former hangs in the position shown when there is no current passing through *C*. When the latter becomes energized, *A* is moved to the right and then the unbalanced weight resists the magnetic attraction of *C*, and, as can be seen, this resistance increases as the deflection of *A* increases.

The construction illustrated in Fig. 1 cannot be used for an instrument that is calculated to be exceedingly accurate, and capable of responding quickly to changes in the current strength or the voltage. The reason why it is not suited to such cases is that iron cannot be magnetized and demagnetized instantly, a certain time being required for the metal to change its condition, causing a retardation of the movement of the particles, and if a large mass of iron is magnetized and demagnetized, the time required to effect a change will be greater than if the mass is small. Now in a measuring instrument the magnetism will increase every time the current increases, and to obtain a sensitive device it is necessary to construct it so that the iron that is subjected to variations in magnetic strength may be as small as possible. In the design of Fig. 1 the entire magnet *M* would be subjected to changes in its magnetic strength by changes in the current, and on that account the action would be torpid.

In addition to making the mass of metal that is subjected to changes in magnetic strength as small as possible, it is also necessary to so construct the various parts as to reduce the friction to the lowest point, and also to make the moving parts exceedingly light, so that their inertia may not be an appreciable amount.

The construction illustrated in Fig. 2 is far superior to that of Fig. 1, as the only metallic part subjected to variations in magnetic strength is the bar *b*, and this, as can be seen, is very small. This type

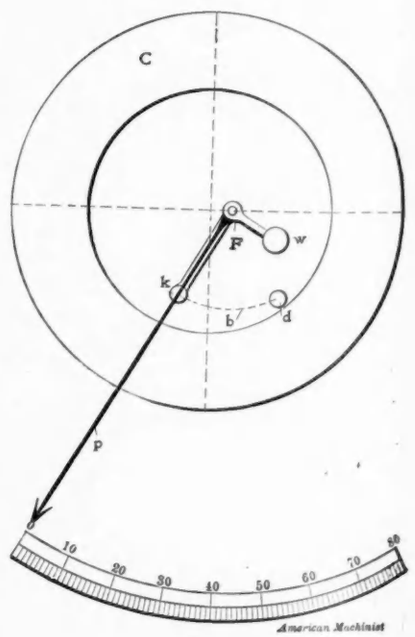


Fig. 6

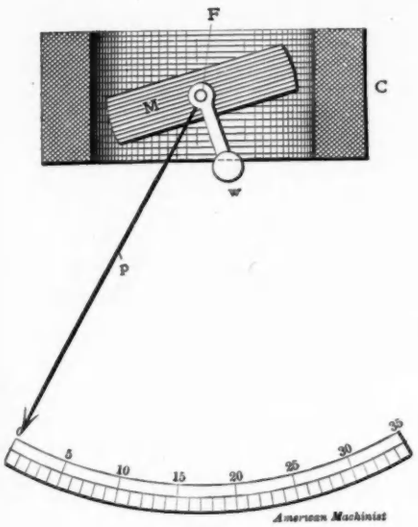


Fig. 7

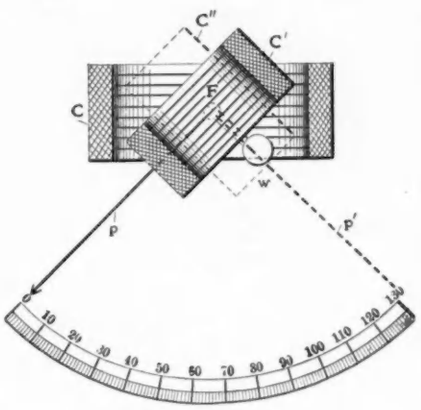


Fig. 8

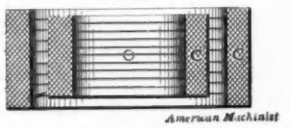


Fig. 9

of instrument is made by several well-known manufacturers. Fig. 3 is not affected by the retardation of magnetism, owing to the fact that no iron is used in its moving part. The magnet *M* is a permanent steel magnet, and the moving system is simply a coil of wire, hence magnetic friction is eliminated. The construction of Fig. 4 was used extensively in the early days of electric development, and Fig. 5 is a well-known form of Edison ammeter. These two designs are not used to any extent at the present time, as they cannot well be made to give as good results as other arrangements, although the same principle is utilized in several modern instruments.

Fig. 6 illustrates a construction which is adopted in many well-known instruments and is capable of developing extreme sensitiveness. The pointer *p* is secured to a shaft *F* which carries a very small rod of iron, seen endwise at *k*. The shaft *F* is not held concentric with the coil *C*, as is indicated in the figure. On account of this position of *F*, when the pointer swings over the scale, the iron bar *k* follows the path *b*, which approaches the side of coils *C*, the attraction of the coil for the bar being greater in position *d* than in position *k*. The weight *w* in Fig. 6, or a spring, furnishes the restraining force, and this being constant, practically, while the attraction of the lines of force increases with the strength of the current passing through coil *C*, it follows that the stronger the current the further around the pointer *p* will swing.

The principle illustrated in these last two figures is embodied in several instruments of well-known make, among which are the Wirt instruments.

In Fig. 7 *C* represents a coil through which the current passes, and *M* may be a bar of iron or a permanent steel magnet. If it is a magnet, then the instrument becomes an inverted form of Fig. 3, in which the coil is stationary and the magnet movable. When *M* is a magnet it can be set in a horizontal position, or, if desired, its left-hand end may be higher than the right; but if *M* is made of soft iron, then it must be set in the position shown in the figure, for if not, it might be rotated in the opposite direction to that desired. This construction is used in several low-priced instruments.

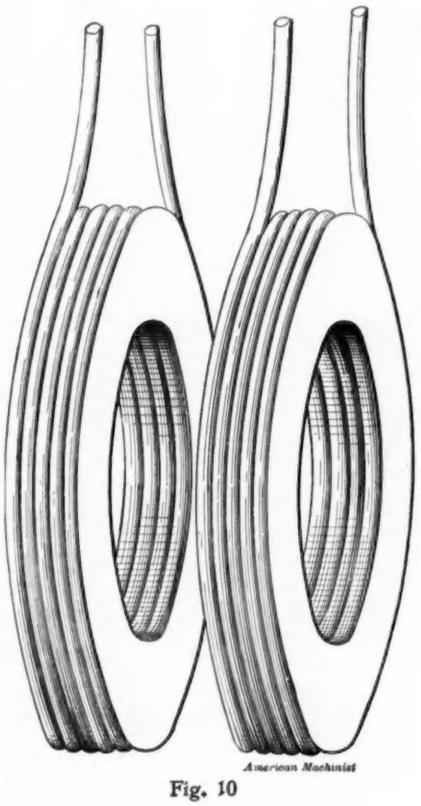


Fig. 10

Figs. 8 and 9 illustrate one of the best known types of measuring instruments, and the one which is the most accurate of all. It is known as the electro dynamometer. There are two coils *C* and *C'*, and the current passing through these tends to revolve them into a position with their axes parallel with each other, as is shown in Fig. 9. The rotative force developed by the action of the two coils is resisted by the weight *w* or the tension of a spring.

The point of superiority of Fig. 8 over all the other designs is, that as there is no iron or steel about it, there is no retardation due to magnetic friction, or hysteresis, as it is called, and also that there is no possibility of the magnetic force changing, as when permanent magnets are used. On this account, when the instrument is once accurately calibrated, it will remain so for an indefinite period if not injured. The principal objections are that the action is easily disturbed by outside influences, and also that the pointer cannot be made to move over equal angles for equal changes in current strength at all points of the scale, hence the divisions have to be placed close together at the ends and wide apart along the center.

Fig. 10 is a modification of the principle used in Fig. 8, in which the motion of the pointer is obtained by the direct repulsion or attraction of the two flat coils, and not by the rotation of one of them.

Fig. 11 illustrates a principle of action entirely different from that employed in any of the previous devices. It is commonly called the hot-wire type, and is used in the Cardew instruments. The lines *W* and *W'* represent fine wires that are secured in the manner shown. From the center of *W'* a light rod forms a connecting link with the end *t* of a lever that swings around *f*. This lever carries the pointer *p*. When a current passes through the wires *W W'* and lever *L*, heat is generated therein, and thus they are elongated, and *L* assumes the position *l* and *W'* the position *w w*. Thus it will be seen that the movement of the pointer is effected by the expansion of the wires due to the heat developed by the current that passes through them. If the wires are very small, the heat will dissipate rapidly and the action will be quick, but with thick wires it will not.

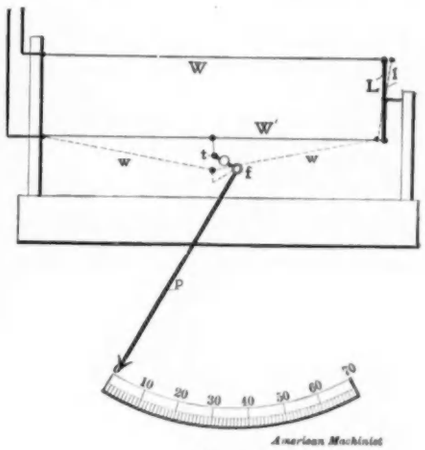


Fig. 11

Technical Education for Mechanics.

I think that Mr. Halsey's article on this subject should be distributed far and wide. By claiming so very high an academic standing the technical schools make a great mistake and compel themselves to teach the simplest rudiments of mechanical or shop work to all their students, whereas they might import a most valuable leaven of shop experience if they would only admit that it is no more derogatory in them to teach the elements of algebra, geometry, or even the A B C of simple arithmetic, than it is to teach the elements of mechanical work. It is all very well to say that the elements of algebra ought to have been acquired at school. This is very false argument indeed. Humanity is not yet all cast in the same mold and from the same material, and anyone who has followed the "proper study of mankind" in the shape of juvenile man will agree that no two boys are alike, and to put them both to the test of the same entrance examination is proof of a certain imbecility on the part of the governing element of the schools. Two boys may be taken at twelve years of age. Call them A and B. A is small and puny, and apparently of considerable intelligence and aptitude. B is dull but athletic. Watch these boys for a couple of years, and, as likely as not, the boy who did his growing when young will now begin to show signs of increased mental vigor, while perhaps the puny youth has as much as he can do to feed a body that has begun to grow, and for a time he ceases to develop his mental faculties. Stupid schoolmasters take unto themselves credit for the mental improvement of B, and deplore the falling off in A as the work of the evil one. They ought to realize that it is only very exceptionally sound constitutions that can find motive power for both developments at the same time. The world lets itself be far too much ruled by the academic element. Turn which way soever you will, and there is some stiff fence of scholastic examination to shut out, as Mr. Halsey remarks, often the leaven of the lot. It is all very well for men, fully grown and of fixed characters, to bend their minds and energies to uncongenial tasks. Boys half-fledged, so to speak, cannot do this, and some men's minds are so feeble in certain directions that they find it impossible to acquire some kinds of knowledge. It has been told me of one of the finest scholars in our University of Cambridge, that had the examination test been rigidly adhered to, he could not have been given his degree, through sheer inability to come up to the standard in the, to him, altogether subsidiary matter of, I believe, mathematics. In some of our own engineering colleges the entrance examination is now made more a means of finding out what the student knows and what he does not know—which latter is usually pretty considerable—in order that he may be placed in those classes for which he is best fitted by his acquirements. Generally his admittance is governed by his rational status as a human being and previous character. The mere desire of a boy to enter a technical school is in itself of no inconsiderable weight, in my estimation, in showing that he is a candidate very properly prepared in his mind for admission. He feels the need of teaching and seeks admission, and as the object of schools is to teach the ignorant, all alike should be able to profit by them. It is fortunate that the common schools do not refuse admission to children who have not been taught to at least read at home. They might as well do so. But for the interests of what Mr. Halsey calls the high-school boys, who alone are sought as students of the technical schools, one would suppose that shop-trained boys would be invaluable fellow students.

The technical schools and institutes of this country are very largely wasted through being confined entirely to evening classes. I tried to utilize one such for a boy who during the day was engaged in practical work, and the following will give some idea of the difficulties of great cities. In order to get to the workshop at 8 A. M. (the latest hour for admission, bar a fog or a late train), he had to walk half a mile to the railway station in the suburbs. Then he had a six-mile journey by train on the worst railway in the world. This latter statement will tell any Englishman that he must have lived on either the South Eastern or the Chatham lines. Arrived in the city, he had half a mile to walk to an underground station and another mile of railway, all in tunnel, followed by a mile walk to the shop. This last mile of walk, by the way, was rendered necessary because the whole of London's government has not intelligence enough to have had an electric line built years ago along the road in question. Arrived at the shop, he then endured the petty persecution of his foreman—why does the Almighty permit foremen to be so often made of such inferior and red-short rubbish?—for no reason but pure personal spite, until about 5.30. There were then two and a half hours to be spent in the city until the first class at 8 P. M., and the boy would get home to the suburbs about 11 P. M. Obviously the physical strain is too much. Yet that same technical institute is closed all day, and its valuable equipment is absolutely idle, and only exposed at night to a lot of youths in various states of sleepiness. Those places that are open by day are too expensive for most people to afford. The old system of apprenticeship has gone out to a very large extent, and there is nothing to take its place. The new system of making millions of articles all alike—sheer repetition work—may be very interesting to the machine attendant for a few days. It may provide him with a good and sufficient means of livelihood, but it cannot be a very intelligent pursuit for a man whose ability is not of the order to enable him to do otherwise. For these reasons it is hoped that the one result of rapid manufacture will be the reduction of working hours, and that parallel with this will be offered and accepted opportunities for acquiring some intellectual pursuit. It is only thus that the demoralizing influence of reproduction work upon the mass of workers can be counteracted. This influence has not been fully realized in America, simply because America is a country not one-tenth occupied. It is very certain that had it not been for the mistaken policy of doing as little work as possible, that was made an article of faith by the English trades unions, the working day would have been long since cut down to eight hours.

But it is of little use cutting down the hours of work unless those set free to greater leisure have the intelligence and knowledge necessary to enable them to use and fully to occupy such hours, and it seems to me that much of the training acquired at technical schools, the more or less familiarization with scientific methods and instruments, will be of inestimable value to those who are not able to get out of the ranks, and it is certain that however much we may talk about every private carrying a field-marshall's baton in his knapsack, very few indeed can ever hope to become even a captain. The drudgery of minding a machine tool is by no means so bad as the drudgery associated with the office stool of the clerk. The one man can think and work; the other cannot well do so, but must drudge long hours at books and figures. It is as much, then, for those who are not going to get out of the ranks as for those that are, that I would have everyone able to acquire some branch of a literary or scientific pursuit.

Perhaps some readers of the "American Machinist" have looked through a large power magnifying glass at a bit of green pond slime on a glass slide. Possibly the piece looked at was not so large as a small pin-head. Yet in one of the several cells that may thus have been brought into focus there will be seen more wonderful movement, more circulation of particles, than in a whole shopful of tools and men. There is study enough for a lifetime in watching the changes which occur as the slime is kept moist or drier, and it is worth working all day for the sake of the evening of observation. I point out this one little thing, because it seems to me that we all have to work in order to live, and that as things now are there are great problems to be faced in the future, problems we have shelved by overflowing into America, and which America has tried to believe would never affect her, yet are already becoming apparent, if not indeed aggressive. There is, of course, much to be said on the other side of the question, but generally, and as things become more and more reduced to standard, the machine attendant's work will become more

and more monotonous, and the percentage who can rise to other positions will become less—not perhaps for lack of ability so much as lack of the positions. It is to meet such conditions that a higher education is needed to enable everyone to have some intellectual pursuit.

W. H. Booth.

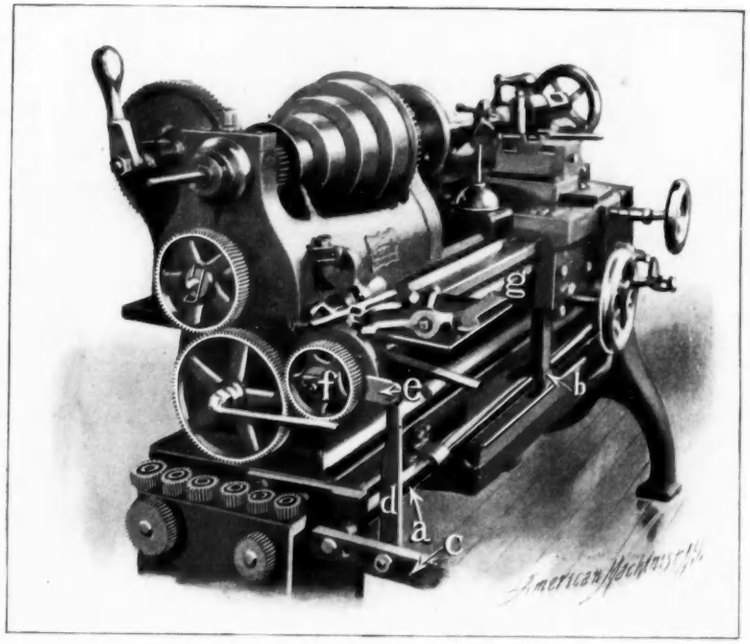
London.

Letters from Practical Men

Correcting Tap Threads for Shrinkage in Hardening.

Editor American Machinist:

The photo herewith shows an attachment on a tool-room lathe in the Northern Pacific Railroad shops at Brainard, Minn. It is a device to compensate for the shrinkage in hardening of long staybolt taps. The bearing for the headstock end of the lead screw is bored larger and threaded



DEVICE FOR PRODUCING MINUTE DIFFERENCES OF LEAD IN SCREW CUTTING.

eight to the inch. A bushing is screwed into this and becomes the bearing of the screw. To this bushing is attached the lever *e*, so that the moving of *e* will rotate the bushing and cause an end motion to be given to the lead screw. Below the apron of the lathe is seen the shaft *a*, which has its bearings in brackets screwed to the bed. This shaft has a very long pitch spiral groove milled in it. One end of the spiral groove can be seen near the head end of the shaft *a*. Attached to the apron of the carriage is a casting *b* through which the shaft *a* slides. In the bore of *b* is fitted a key or feather to slide in the spiral groove of *a*. At the head end of *a* is fastened a slotted arm *c*; *c* and *e* are connected by the link *d*.

In cutting a thread on a tap, the usual gears are connected and the lathe started. As the carriage moves, the feather in *b*, by sliding in the spiral of *a*, causes the shaft *a* to turn. This motion is transmitted through the slotted arm *c*, the link *d* and the arm *e* to the threaded bushing spoken of. The rotation of this bushing draws the lead screw, and with it the carriage and tool toward the headstock (if cutting a right-hand thread), giving a travel of the tool greater than that caused by the rotation of the lead screw alone and increasing the pitch of the thread cut. The amount of this increase may be regulated by sliding the lower end of the link *d* in the slot of *c*, increasing or decreasing the movement of *e* and the bushing as desired. The slot in *c* is graduated, so that when it is found just what setting gives the necessary correction to allow for hardening a given steel, the setting can be recorded and duplicated at any time.

I was informed by the tool-room foreman that this device had proved very satisfactory. It does not interfere in the least with the ordinary working of the lathe, as the attachment may be readily disconnected when not in use.

These shops are very progressive, being well supplied with compressed-air hoists and tools, and supplied by an air compressor instead of the regular air-brake pump so often found in railroad shops. The machinery is arranged in groups and driven by electric motors. The master mechanic is a man of originality and push, and the shops are rapidly improving under his management. J. H. Gill.

University of Minnesota.

Has the Blacksmith Kept Pace With the Times?

Editor American Machinist:

In my experience I am inclined to answer the above question in the negative. And why? The answer would seem to justify the opinion of "The Blacksmith Who Had Graduated," in your issue of February 8.

While there is at present, and will be in the future, plenty of work in this trade calling for brainy men, I feel that I must admit that we are being outdistanced by other tradesmen from an intellectual standpoint. In order to be abreast of the times we must have intelligent minds predominate. "One swallow never made a summer," and a few intelligent blacksmiths cannot save the whole. Now, why do I make this statement? Simply because I have found that for every blacksmith regularly reading a good trade journal I find twenty-five machines. The blacksmith will say there is no good trade journal for our business, and I agree with him; but is this not a severe commentary on our scant desire for reading? I claim that if there was a demand for it there would be a good trade journal in the field devoted to the blacksmith trade; but as it is one buys a machinists' paper with an occasional note on blacksmithing down in the far corner.

Now, there are several trade papers in the field devoted to machinists' interests. Here you get an interchange of ideas on practical, every-day subjects bearing directly, in many cases, on work actually going through the shops. The individual ideas may seem to be insignificant, but by the pressure of them collectively a man can often make deductions and arrive at conclusions quicker and far in advance of what he otherwise could have done. When this reading, thinking element so largely predominates in any particular trade, that trade will draw brainy men to it.

I often wish that our trade was attractive enough to draw thinking and progressive men to it. I have noticed that in the manual training schools connected with our best colleges nine out of ten of the students consider the time and labor spent in the blacksmith shop as merely developing muscle, and beyond this they seem to have little interest in it. Now, these very students are the ones we all hope are some day going to bring the trade up to the "artistic standard" that we all, including Mr. Tecumseh Swift, would like to see it hold. Will we realize our hopes by the aid of this class of students?

Take, for instance, the graduates of the academy or the high school, and very few of these young men, I will say none of them, think of such a thing as going to learn the blacksmith trade.

If the "space" left vacant behind the anvil by the retirement of "Florin's"

"Blacksmith Graduate" could be taken by some smart, active, brainy young man willing to give his talents and his life to the trade, and if this held good all along the line, how quickly then would we take our place in the front rank, as in former days. A BLACKSMITH.

"The Salary Expected."

Editor American Machinist:

Having noticed several letters in the pages of the "American Machinist" regarding "The Salary Expected," it stirs up some recollections of the past. There have been times when it has seemed best for sundry reasons that a change should be made in my location. Without wishing to be egotistical, I may say that I have always tried to be as near the top in my line as it has been possible for me to get, and I have filled all positions, from that of "boy" to manager of more than one large plant, but I have often thought that there should be something still better for me if I only knew where to find it. I have not always made a change, however, when these thoughts have come, for it is true that a "bird in the hand is worth two in the bush," and sometimes by *hard work* I have brought matters around so that there was a radical improvement where I was located, but three or four times, in order to see what chance there was for one who was inclined to be like Oliver Twist and want more, I have answered an advertisement, and I have found that the salary wanted was a big bugbear in the way of getting or giving satisfaction. In different localities the value of a man may vary to a great extent. Cost of living may be very different, as I have found by actual experience. For instance, I might be located in a small place surrounded by good farms, and where all sorts of produce would be very low in price. Three years since I was in a place on business where potatoes cost 12 to 15 cents per bushel, butter was high when it was up to 12 cents per pound, while, owing to competition, clothing and kindred articles were as cheap as in many of the larger centers. If a company in such a place was wanting a man and if I had been living, as I had for some years, where potatoes cost 85 cents to $1 per bushel, and butter was considered cheap at 30 cents per pound, any price which I might have set upon the value of myself would have been considered so high that I could not have had one single chance to get a position that might be better, at a price that the people there would pay, than anything else I could get; but I have only my own experience to go by, and that calls for the higher amount of salary. Suppose I had been living in the place referred to, and some parties wanted just such a man as myself, but in a place like that in which I had been living. I make a price that is quite a considerable higher than the ruling salary in my location, but, owing to the facts named, these folks know that I could not live as I should in the position they want filled, and they say at once, "that man is not good enough for us."

I know by experience that these things are just this way, but what shall we do? Can we induce the advertiser for a man to give a list of the markets of his place and show photographs of the houses for rent, with an affidavit as to the character of the neighbors of each house, and state just what it will cost for car fare and the other extras to live in that place, or have the one who is looking for a new situation state that his views as to salary are based upon a certain market price for milk and eggs? Of course, it might be said that they should not go so far away as to have such a difference that they could not make an intelligent estimate, but it does not require a very long journey in these days to get where there is a great difference in the cost of living and the demand for workmen.

At this time I know of a manufacturing plant that is located less than one hour's ride from one of the largest manufacturing cities in this country, and yet the wages in that place are only about two-thirds what they are in the large city, and the actual total cost of living only about one-half, making quite a difference in favor of the small place; but, for all that, they are not crowded with men after positions, nor are they in any great hurry to make their salary list the same as it would have to be if in the city, and if a man should apply there for any responsible position he would be told how cheap it was to live and how little they could pay.

About ten years since two different parties wrote me that they had been told that I was willing to make a change, and asked some questions as to my experience in certain lines, and they each ended their letters by asking what salary I would want to go to their place. I answered both, telling as near as I could what I could do in their lines, and named the same amount in each letter as the sum I would be willing to make an attempt to handle their wants for them. To one a reply came about like this:

"You evidently think you are capable of doing what we want, but it is very evident you have not had much experience in our line or you would not be willing to come at that salary, and we have concluded to try another."

The very next mail brought a line from the others:

"If you are capable of earning the amount you mention you are a better man than we need at present. We will place your name on file for future reference."

I guess the file must have been lost. I am not looking for any situation at this time, but do not know how soon I may want to know how much to ask for a salary in answer to some promising advertisement, and I would like to be able to make a good guess as to what I might be worth, and also as to how much the business would stand. EZEKIEL.

The Carnegie Profits—The American and English Planing Machines.

Editor American Machinist:

In studying over the article on "The Carnegie Profits," in the "American Machinist" of February 22, the question came to my mind: Would it have been better for the country if Mr. Carnegie had lowered the prices of steel so as to have made only a moderate profit, rather than to do as he did and pocket the profits? It is safe to say that the prices of steel rails, beams and such structural materials were only such as to give a fair profit to others in the business, and had the prices been lowered, it is safe to assume that they (the others) would have been driven out of business.

Because the Carnegie industries have made unusual, likely enormous, profits, I can see no reason why anyone should complain, if it has not been done by grinding it out of the men, as admitted; and what difference does it make, except to the other forty-nine men, whether the industries are owned by one man or fifty, except that the fifty may or may not make the better use of the money?

In the address which you published, by Dr. Coleman Sellers, reference is made to two double-head four-tool planing machines, one American and the other an English copy, wherein the only difference appears to have been that in the original the tools were set facing, two tools cutting on the forward stroke and the other two on the back; whereas in the case of the English copy all four tools cut at once, the table (presumably, at least) having a quick return. It is true enough that "the power of the American machine was double that of its English copy, all other things being equal;" but it must be plain from a brief consideration that the English machine would not only do as much as the American, but as much more as is gained by the quick return motion in any planing machine. The English four-tool machine would do just four times the work of a single-tool machine, while the American machine could only do the work of four single-tool machines where all returned at the same speed as the forward motion. The driving power would need to be stronger, but the power consumed would be no greater because of the quick return. The pull in making the cut would be twice as great, but would last only half as long. JOHN E. SWEET.

Cylinders Under Internal Pressure.

Editor American Machinist.

With much pleasure did I read the first part of Mr. Alfred Peterson's article on

"Cylinders Under Internal Pressure," in your issue of February 15. When I turned to page 162 and saw it bristling with algebraic equations, the "hyp. log." and the names of Reuleaux, Brix, Lamé and others, I said:

"Ah, here's the rule I long have sought,
And mourned because I found it not."

No longer (after the next edition of my book), thought I, will I disappoint the users of the book in making "no attempt to show which formula is right or which one may be used with safety." No longer will I "leave the subject in as dark a state as any of the older pocket books," and be obliged to confess that the reason I did so was because I did not know which was the right formula.

How great was my disappointment, however, on finishing the article, to find that the subject is still in the "dark state." Mr. Peterson gives us formula (7), which is very handy as an approximation to formula (3), but he does not show that either one of the seven formulas is the right one. Will he kindly throw some further light on this dark subject?

WM. KENT.

Turning a Sixty-inch Roll With a Twenty-inch Lathe.

Editor American Machinist:

Some years ago, while working in a small shop, the "Old Man"—he was nearly thirty then—tackled a job that kept some of us guessing until he explained how he intended it to be done, when it looked very simple indeed. These little shops have a way of their own for getting around jobs that would make some of the modern machinists—I mean specialists—stare with wonder; but the fellows from the little shops stare in their turn when they first gaze on the modern shop, and see the number of tools, the uses of which they can't imagine, being accustomed to do mostly everything on a lathe or planer.

This particular shop was located in a little water-power town where paper-making was the chief industry, and our business was to keep the wheels a-humming by keeping everything in repair. The particular job here spoken of was the turning of a 60-inch drier roll which had become cut on the ends. It was necessary to reduce the diameter of the roll nearly an inch to restore the surface to its original width.

The largest lathe we had was a 26-inch, but the Old Man thought that too heavy, so we took a 20-inch with 12-foot bed. The length of the roll was about 8 feet; we did not take the complete lathe though, just the bed and carriage; loaded them on a wagon and took them to the mill and set the bed up on the iron frame of the machine, something like Fig. 3. After setting as close as possible by means of the uninjured part of the roll and a tool in the carriage, the bed was rigidly clamped to the side frames of the machine, the tool being blocked, as shown, and bolted to the carriage. We decided to use the screw feed, as it was nearly under the cut, thus avoiding any unnecessary twist which would result from a use of the rod feed, the proper feed being obtained by belting from a large pulley on the screw to a slow-running shaft overhead. The proper cutting speed was obtained by partly closing the water-wheel gate, the roll being driven by gear and pinion.

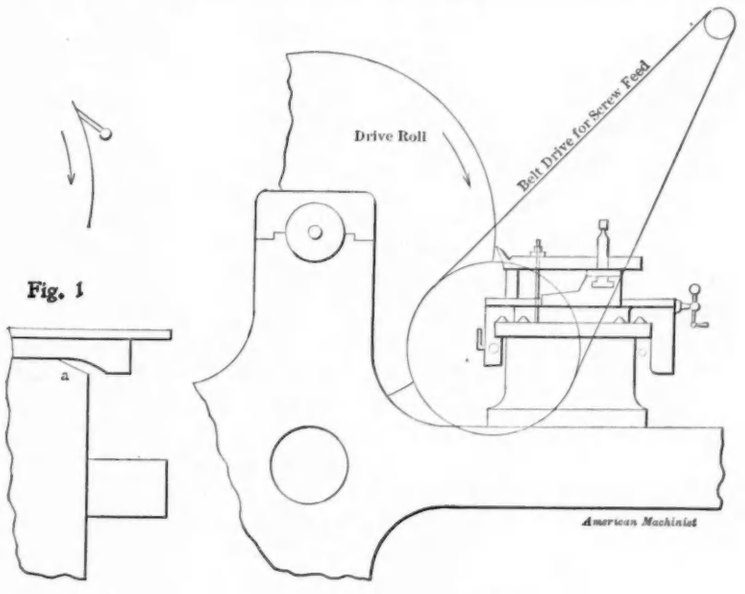


Fig. 1 Fig. 2 Fig. 3

TURNING A 60-INCH ROLL WITH A 20-INCH LATHE.

While we have a good cut on, I'll satisfy those who will want to know how the roll became damaged, and for their benefit I'll begin at the beginning. A drier is a hollow cast-iron cylinder which revolves at the same surface speed as the paper is to be run. Live steam is admitted through one of the journals for the purpose of drying the paper as it passes over the roll; the length of this and other rolls determines the width of the widest paper that can be run on the machine, and the surface must be sufficient to evaporate all the moisture in the paper during the time it is in contact with the roll. On modern machines the paper passes successively over as many as sixteen driers, thus expediting the drying process, which makes it possible to run at a great speed even on the heavier grades of paper. This machine was of a type known as a single drier, and was used in the manufacture of tissue paper. The machine had been run on paper somewhat narrower than the machine for some time, and the condition of the drier was not noticed until it became necessary to run paper the full width of the machine. Driers, and nearly all rolls on a paper machine, are provided with scrapers, or, as they are generally called, "doctors," to remove any pulp or other matter from the rolls. They are made of a flat steel plate, set into a round shaft and held against the roll, something like Fig. 1, by means of springs or weights. To prevent the formation of ridges or grooves, the "doctor" is given an irregular lateral motion, which should be so proportioned that the ends of the "doctor" are subjected to the same wear as the middle portion. In this case the "doctor" was nearly 3 inches longer than the drier, and the motion was hardly an inch, both roll and "doctor" gradually assuming the form shown at *a*, Fig. 2; the action being somewhat similar to that of a slide valve that does not run over its seat. After the roll was finished, a new "doctor" was put on, and no more trouble resulted. The way we calipered the roll was with a wire carefully stretched around the roll at one end, and nicked with a cold chisel where the ends came together. As several cuts were necessary, the final result was very close.

G. J. M.

[We need not doubt that the turning of the roll was very well done by the admirable arrangement which our correspondent describes, but a question is naturally suggested as to how the surface speed of the roll was restored after its diameter was so reduced.—Ed.]

A Tool Maker in the Drafting Room

Editor American Machinist:

A practical toolmaker with a fair education in figures and drafting, a clear head and a ready eye for reading drawings, could do much efficient work as an advisor to the machine designer. Looking over the work with the draftsman, and having in mind only the shop methods, use of tools, etc., he would be in line to suggest such changes that, while not interfering with the general design, would dispense with many tedious and expen-

sive jobs of machine work and tool-making. This suggestion would be of no value to the small shop, where the superintendent, shop foreman and draftsman are chums, getting their heads together always, in consultation over the most trivial question, but would be of benefit to the large manufacturing concern, where, after a drawing once enters the shop and a change is required, it results in the use of the requisition card or printed form, filled out, with the signatures of shop foreman, superintendent, manager, chief draftsman, and much other delay caused by the usual so-called but necessary "red tape."

Then again, however practical a man the draftsman may be, thoughts of the processes of manufacture of his work are crowded out of his brain by the study of the end to be attained in his design; also after finishing a job of perhaps weeks' or months' duration, he is tired of it, glad to get it out of sight and start again on something new, he rarely, if ever, watching the progress of his former work through the various machine departments. Our special man would be in complete accord with the factory, would keep in touch with the shop foremen and toolmaker, and be ever ready to furnish information or suggestions to the draftsmen, as well as promoting harmonious relations between the drawing room and the machine shop. D. E. MacCarthy.

The Spur-Bevel Gear.

Editor American Machinist:

Referring to your illustration (February 15, page 156, Fig. 9) and your remarks on "The Fellows Spur-Bevel Gear" (February 22, page 177), permit me to state that the identical curio in gears, but applied to bevel instead of spur gears, was illustrated in your issue of October 12, 1893, Fig. 84. Hugo Bilgram.

[Mr. Bilgram here refers to the "abnormal" bevel pinions exhibited by him at Chicago and illustrated and described in the issue referred to.—Ed.]

The "Settling" of Cores.

Editor American Machinist

In making a pattern and core box of Mr. Willard's description, in your issue of February 8, the same amount of shrinkage between centers *A* must certainly be allowed on the core box and on the pattern. For example, if the distance between centers was 36 inches, and ⅛ inch shrinkage to the foot be allowed on the pattern, according to Mr. Willard, then by allowing 1-16 inch to the foot shrinkage in the core, there would be a difference of 3-16 inch between the centers, and consequently when the molder attempted to put the core in the mold he would find the core 3-16 inch too short, with the result of "shaving" the core to suit the mold.

A core of his description and size, if made in halves, after being turned out of the box, will swell, or, more properly, settle, to a small extent, caused by the dampness of the sand, but will not grow longer or shorter between centers; so provision must be made in the core prints by having them about 1-16 inch larger in diameter than the required size of the core, thus allowing that much for settling, which is ample for a core of this size. In larger cores more allowance must be made in the prints for the settling of the core.

If two half cores of large size be made from a half-core box, and turned out on a plate and dried, the size at D, Fig. 1, should of course be one-half the size at *C*; but it will be found that such is not the

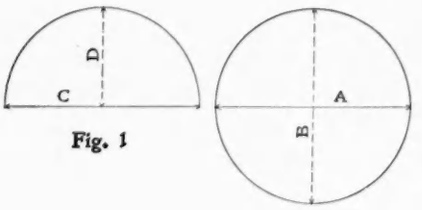


Fig. 1 Fig. 2

THE SETTLING OF CORES.

case, on account of the core settling after being turned out of the box, and if the two halves are put together the diameter at B, Fig. 2, will be almost ⅛ inch less than the diameter at *A*, considering that line *A* is the parting, and the core 18 or 20 inches diameter. To remedy this, the core box should be made almost ⅛ inch deeper at *D* than the radius, and it will be found upon putting the two halves together, that the core will be almost perfectly round.

Therefore, when making a pattern of any description, the settling of the core must be taken into consideration, and the proper allowance should be made in core and prints; but the distances between centers of prints must always be the same on core box and pattern. Louis Baden.

Hamilton, Ohio.

Roller Jaws for Pipe Cutting Machines—Shrinking Collars—Old Time Boiler Material.

Editor American Machinist:

A correspondent in a recent issue of the "American Machinist" asked for the best shape and plan to make the chuck jaws of pipe-cutting machines. I would recommend him to use four jaws pointed at the usual angle, and slotted in the direction of the axis of the machine ⅜ or ½ inch wide. In these slots place steel rollers turned to an edge at an angle of about 60 degrees, or two edges at the same angle with a V-groove between. Use stout pins of tool steel for the rollers to revolve upon. Jaws fitted with such rollers will be found to hold much better than those having the ordinary solid square edge points and the edges will keep sharp much longer, since they have a circumference equal to about four times the length of a fixed edge, and since they act as rollers instead of dragging on the pipe when it is being placed or withdrawn.

The edges being circular will indent the pipe deeper, perhaps, than straight ones, but will not mar it so much, unless it should slip, in which case they would mar it far more; but the pipe will not slip if used carefully.

. . . . .

Sometimes it is desirable to reduce the size of a collar or a hub in case of a misfit or otherwise. One of our boys suggested the plan of heating the collar red-hot, then holding it over a tub of water with the edge touching the water, and revolving it until the circumference is cooled. This shrinks the red-hot interior and reduces the diameter ultimately one shrinkage. The scheme may not be entirely fresh, but it is good.

. . . . .

Boiler explosions are fewer than formerly and occur now only through the grossest ignorance or carelessness, owing to the excellent materials of which boilers are made. But very few of the younger engineers have any idea of the difference in quality of boiler plates between the old times and the present.

An instance with which I was familiar occurred on a steamboat, and will serve to illustrate. The boilers were being patched and the boiler maker had just cut out a section over the bridge wall. The engineer removed it out of his way, and upon throwing it down on the deck it actually broke in two. Yet these boilers had been carrying 150 pounds of steam every trip. This happened early in the fifties. C. W. Crawford.

Brazil, Ind.

The Swelling of Cores.

Editor American Machinist:

A letter from a practical man on pattern or core making, or in fact upon anything pertaining to or in connection with the foundry, always interests me. Mr. Willard's letter on "The Swelling of Cores," in your issue of February 8, interested me more than usual, because I most emphatically disagree with him. This "disagreeing" business is, no doubt, the fountain of knowledge. It creates discussion, and often brings to light new ways of doing things, or digs up old and forgotten ways, and so we all know more.

It would be impossible to lay down a rule for allowance in the swelling of cores that would suit all shops and all classes of work, as a great deal depends on the class of labor employed and the materials used. As a general thing, a core after it is dried will not or cannot be put back in the box it was rammed up in—for the reasons stated by Mr. Willard, and also because a core settles more or less after it is dumped out of its box and has nothing to keep it from spreading but the atmos-

phere. Still, I have seen cores, and fair-sized cores too, that would and did go back into the boxes they were made in, but they were exceptions to the general rule.

Most shops make an allowance for round or half-round cores swelling in their diameters, but none that I have ever worked in would "stand" for any variations between the centers on the pattern and the centers on the core box, in a job such as Mr. Willard describes. I think most pattern makers who have traveled from shop to shop and have had experience on this kind of work will agree with me in saying that Mr. Willard is wrong in making that pattern and core box as he suggests.

That particular core will probably gain some in its diameters in the making, still, if it is carefully made and properly rodded, or made on an arbor, there is no good reason why there should be any variations between the centers of the finished core and the box it was made in.

I have worked in many pattern shops, and have seen all kinds of allowances made for cores swelling in their diameters, but none of them ever allowed anything for swelling between the centers of pipe branches. If the pattern is made in halves, the "boss," when he measures it up, will invariably lay one half joint down on the box to see if the core prints on the pattern and on the core box are an exact match, and if they ain't—that's your cue to pack up. "HOBO."

Editor American Machinist:

I am somewhat surprised that Mr. Willard should be asking a question like the one he asked in the issue of February 8; but for his information I will say that the core box should be made the same shrink as the pattern, as far as the distance between the branches of pipe goes. Cores swell in baking, without a doubt, but the swelling simply takes place on the surface all over the core, and does not affect the distance between centers. The diameters of the core box may be made to a lesser shrinkage than the pattern on work that is to be run thin, but on work where there is a good body of metal I think it wise to turn the core-prints a little large and make the core box right up to the shrinkage used on the pattern, for the metal will burn its way into the core enough to make up for the swelling. I find that on cores 12 inches in diameter, about 3-32 inch is enough larger to turn the prints, and on cores 24 inches in diameter I would make the prints fully ⅛ inch larger.

O. E. ORTON.

A Forming Die for Hard Brass.

Editor American Machinist:

A few years ago, while working for a well-known camera company, I had occasion to make a forming die for forming a piece of hard brass at right angles. We first tried to form in the usual manner, with a punch and recessed die, but found that, on account of the spring in the brass, the work would not remain in the proper shape. For example, the piece had to be like *A*, but it was found that when formed by the usual tools it would assume the shape *B* (slightly exaggerated). We then made a punch and die like the sketch for the second operation, which we found to be highly satisfactory. The punch, Fig. 1, consists of the usual holder, bored out to receive a plunger, with a pin driven through it to fit the slot in the shank, and held down by the spring. The die consists of a piece of steel planed to the desired angle on the sides to fit the shoe of the press, the center of former *a* being slightly undercut to accommodate the spring of the brass, and fastened by three

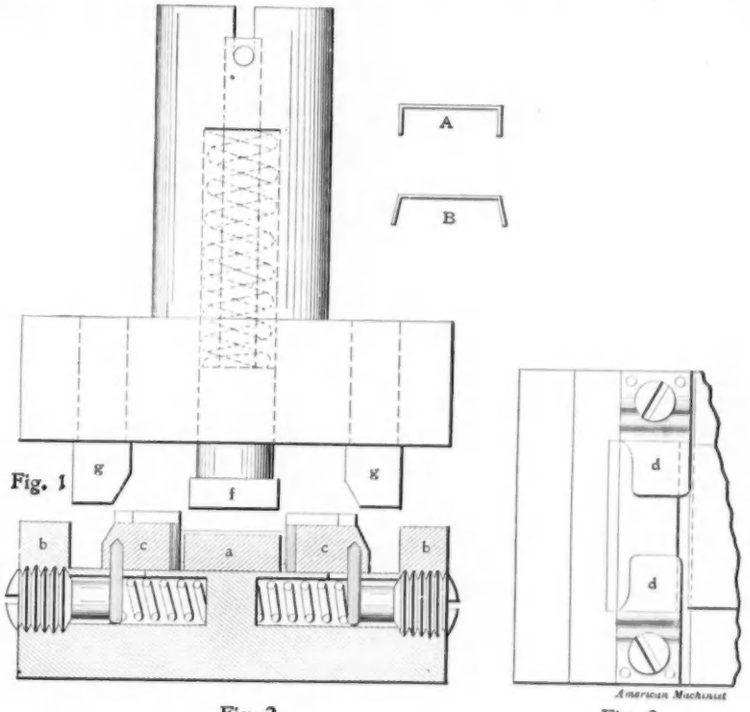


Fig. 1 Fig. 2 Fig. 3

A BENDING DIE FOR HARD BRASS.

screws and two dowels (not shown), the ends *b b* also being fastened in the same manner, and two hardened blocks of steel *e e* traveling in the guides *d d*, Fig. 3, and forced back by the springs *e e*. The press travels downward until the pressure plate *f* comes in contact with the work, holding it firmly on the former. Continuing its downward stroke, the two lugs *g g* engage the steel blocks *c c*, forcing them forward with sufficient force to form the work, as shown. W. E. CALLAGHAN.

Erie, Pa.

Saving Time and Money on Pattern Work.

Editor American Machinist

We have often had to get patterns out in a hurry from drawings just completed. On a recent job, owing to obstructions met with in the developing of a new machine, our time left for pattern work was very limited. The item of cost also entered into the deal, and we hit upon the following plan to save both time and money. Estimates were obtained from three or four patternmakers, but instead of getting figures on the work complete, we called for separate estimates for the patterns contained on each sheet, also the time of delivery for each sheet was asked for.

The result was a saving of from ten days to two weeks on a large job by splitting up the work among three or four patternmakers. It was surprising to note the saving of money by comparing the different patternmakers' prices for each separate sheet. Dividing the work in this manner actually saved us from $30 to $50 on pattern work amounting to $200. In these days of sharp competition on all sides, such a saving, both in time and money, helps materially to obtain the work and deliver on time. I do not doubt but that other machinery manufacturers have adopted this scheme, and that it is perhaps very old and often resorted to. However, having never seen it published in your columns, I think it may be of aid to some readers or manufacturers.

WM. ZOELLER, JR.

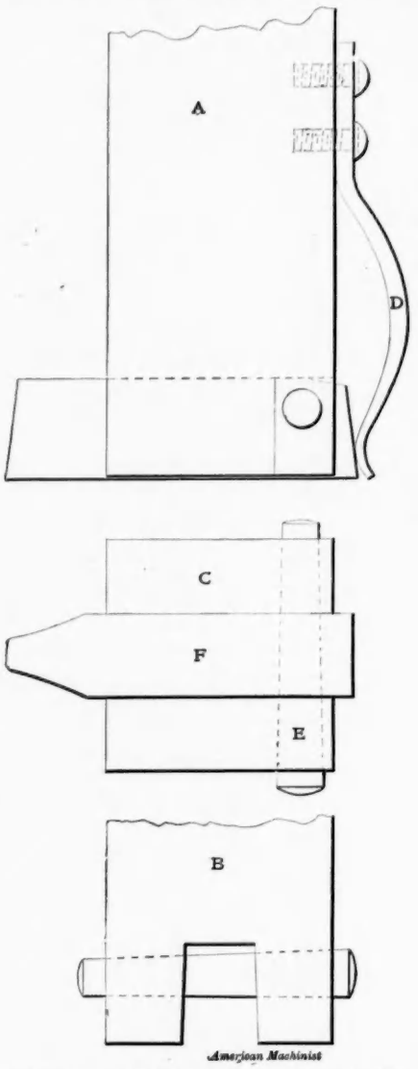
Chicago.

Tool for Cutting Gears on the Slotter.

Editor American Machinist:

I send you sketch of a slotter bar. We had some large steel gears to cut, and as they were too large for the milling ma-

chine we had to cut them on the large slotter. The bar shown in the sketch was used with the best results. As it is a very cheap and simple one to make, I thought it might be of some interest to your readers who have similar work to do. The bar *A* is 3½x3½x30 inches long. The hole for the taper pin *E* is reamed a shade larger in the tool than in the bar, to allow the tool to move freely on the pin. The taper in the slot holds the tool very rigid, and prevents it from wearing itself free. The tool, if made properly, can be ground on its face without changing the form. The



TOOL FOR CUTTING GEARS ON THE SLOTTER.

tool will do a good amount of work without grinding, as it relieves itself on the upward stroke and is quickly returned to position by the spring. The tool can be taken out and ground without the trouble of resetting. J. F. MORGAL.

Highlandtown, Md.

A Triangle for Drawing I-Beams, Etc.

Editor American Machinist:

Noticing the article in the "American Machinist," February 8, on "Triangles for Laying Out Threads," I take the liberty of sending to you this sketch of a triangle for laying out bevel sides of I-beams and channels. It takes a little time to cut it out of the celluloid triangle, but in the end it is time well spent, as with its aid a neat-looking I-beam can be drawn. It is not new by any means, but at the same time I suppose there are a good many that have never used it. C. C. R.

Tinning Process—Lining for Vitriol Tank.

Editor American Machinist:

I notice in the "American Machinist," February 22, under the head of "Tinning Process for Iron Ware," that the writer, F. C. F., claims the vitriol pickling tank used should be zinc lined.

I beg to say that if the pickling tank is lined with zinc it will last but a very short time under the action of a bath containing vitriol.

Solder also is acted upon, but in a milder form, and for this reason all tanks used for this purpose should be lined with lead and the seams burned together, not soldered.

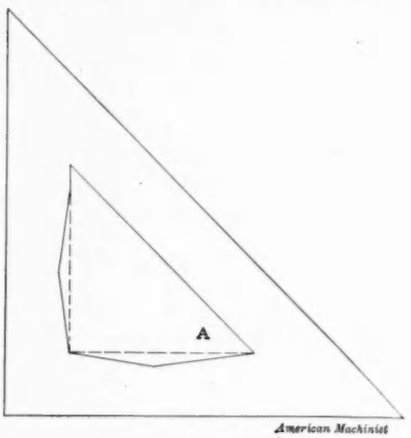
Hoping this may be of benefit to some of your readers, I am

RALPH ENTRIKEN.

Repairing Hydraulic Crane Plungers.

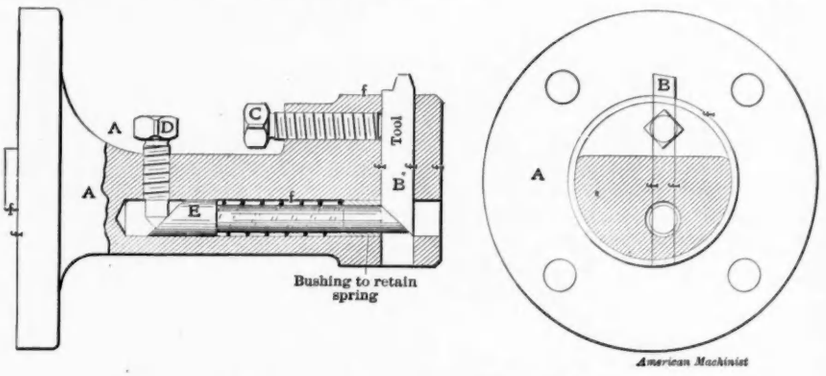
Editor American Machinist:

During the winter of 1896, after an exceptionally cold spell, during which we had been shut down for repairs, when ready to start the steel plant we made the discovery at the last moment that three of our hydraulic crane plungers were cracked, the crack extending about one-third the length of the plunger, near the middle, and open about 1-32 inch. The plungers were supposed to be watertight, having a 4½-inch core with a turned plug driven in the bottom. Water had accumulated in them, however, and too much cold weather made trouble. They were brought into



TRIANGLE FOR DRAWING I-BEAMS AND CHANNEL SECTIONS.

the shop and drilled and countersunk for 2-inch patch bolts. The bolts were turned to fit, threads were cut on them, and when everything was ready we heated the bolts in the middle and screwed them down, cooled them, cut the heads off, put the plunger in the big lathe, put on about a ⅝-inch feed, and in a short time they were in service, and have not leaked any since. J. G.

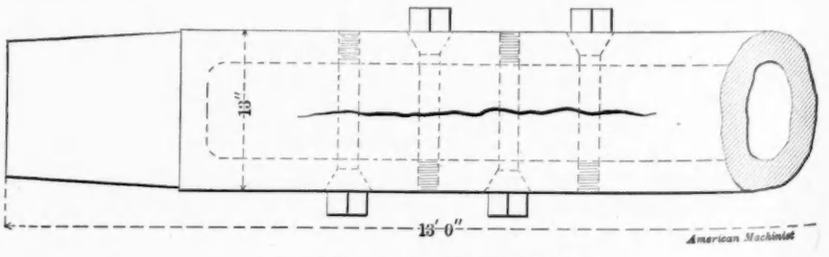


A SPECIAL BORING AND THREADING TOOL.

A Special Boring and Threading Tool.

Editor American Machinist:

Some time ago we had a number of cast-iron retorts, one end of which it was re-



REPAIRING A CRACKED PLUNGER.

quired to bore and thread to fit a plug about 4½ inches diameter. This was done by blocking the retort on the lathe carriage and using a special boring fixture on the lathe face-plate. While this tool is a modification of a simple form in common use, it may, however, be of sufficient interest to warrant a brief description.

From the sketch it will be seen to consist of a cast-iron body which is bolted to the face-plate. This body is slotted to receive the boring or threading tool *B*, which is secured in place by the set-screw *C* and the conical-pointed set-screw *D* acting through the piece *E*. Both ends of the piece *E* are beveled at an angle of 45 degrees. It is also shouldered down, so that a light spring will keep it against the adjusting screw. When used for cutting the thread, the tool is first set and clamped in position by means of the set-screws. After a cut has been taken, the set-screw *C* is loosened and the screw *D* run back, allowing the tool also to back clear of the cut. The tool is then lightly clamped, while the lathe carriage runs back. The tool is placed in position for the next cut by screwing down on *D* and then tightening the clamping screw, and so on. While this arrangement answered very well for doing a small number, it is rather slow, and I would be glad to hear of quicker methods. J. A. B.

Philadelphia, Pa.

Effect of Rear Driving to Roughen the Road for the Automobile.

BY M. C. KRARUP.

The work expected of most machines that a constructor may be commissioned to design is susceptible of definition in exact terms of power, movement, etc., but that of an automobile is variable and elusive, covering so wide a range of possibilities that constructors apparently have absolved themselves of all obligation to consider any of them minutely.

Apart from the motor problem, the mechanics of automobilism are mostly self-evident if they are only at all considered, and a discussion of them is therefore likely to be tedious, but I think it is true of most designers that they have been so absorbed in the motor problem that the irksome task of plodding through the more elementary considerations involved in general design has been too much for their patience and has appeared more unnecessary than it really is. While these considerations are so simple that they need only to be mentioned to be also realized and appreciated, it seems none the less needful that this mention should be made and that the main points should be well threshed out.

In a previous article the proposition was nearly threshed out that the necessity, which crops out in experiments with automobiles of the currently accepted general design, for constantly adding material and weight in unexpected places in order to gain the strength that experience shows to be necessary, means a danger of breakage through the natural inclination of the designer to underestimate this necessity in his desire to avoid weight and comply with the public's demand for an appearance of lightness and elegance.

Whether the double function of the rear wheels of automobiles as drivers and carrying wheels is consistent with the requirements for vehicles that are intended to travel over all kinds of roads, or is one of the features in current American design that have been accepted on faith and under the hazardous assumption that it has been proved acceptable elsewhere, and consequently must be so here, is one of the questions that arise at once after one has realized that the automobile problem has as many heads as Hydra, varying with the conditions under which the automobiles are to be worked.

The most fundamental, though not the most important, objection to the accepted driving system would also apply to front driving, and has reference to the handicap that the designer accepts when he undertakes to combine correct construction for driving wheels with the general appearance of carriage wheels, from which the public is unwilling to depart very far so long as the wheels otherwise take the place of carriage wheels to the eye of the casual observer. While nobody objects when the driving wheels of certain agricultural implements have the iron spokes wound partly around the hubs, it is barely that the public will permit tangentially laced suspension wheels for an automobile, as these do not look so trim as the radially spoked suspension wheels used for sulkies and light carriages. But the constructor who begins to compromise on this point gets into trouble at once. The driving function compels tangential spokes or else the application of the power near the rims of the wheels; and the latter expedient has not proved very successful. One maker of electric carriages, for example, has abandoned the method of fastening the large spur wheel driven by the motor pinion to the wooden spokes, on account of the difficulties in placing and keeping it (after exposure to weather and wear in the bearings) accurately enough adjusted for correct meshing, and has returned to the older method of securing the spur wheel directly upon the rear axle by means of a large, robust disk of metal, thereby assuming the obligation to strengthen the axle and hub beyond anything that would be necessary for the mere carrying function of these parts, although the strength required for carrying is already considerable on account of the weight of the vehicle.

This is only one instance in which the disadvantage of designing automobiles in one compact structure is apparent. By so doing each of the four wheels may at times be called on to resist an impact to which the momentum of the whole structure lends force, necessitating that it should be strong enough to resist very violent shocks which, moreover, may take a direction not parallel with the plane of the wheel. A comparison with horse-drawn vehicles illustrates the point. An ordinary buggy or runabout weighs from 150 to 200 pounds, and all that its wheels must be strong enough to resist are such shocks as may be caused when this weight, plus load, is bumped into a hole in a bad road. The weight of the horses need not be considered. The automobile, on the other hand, from which similar service is meant to be be obtained, weighs from 470 pounds, in the case of the lightest steam vehicle, to about 1,500 pounds (leaving still heavier racing vehicles out of consideration), and its wheels must therefore be able to resist shocks from three to ten times greater, and this entirely apart from the greater speeds at which they are expected to be driven. They must resist these shocks in nearly all directions, and while the rotation of the wheel may somewhat protect the rims and spokes in most cases, namely, when the obstruction is not large enough to stop the vehicle when progressing, a factor of safety must yet be left for exceptional cases. Under all circumstances the shock is transmitted to the hub and front axle of the front wheels, and everybody knows how often just these parts have been found wanting in strength during the exploits of automobile builders in the past year. The front wheels being connected with the steering mechanism, the shocks referred to are also transmitted to this portion of the structure, and it is here notable that the more sensitive said steering mechanism is —and a sensitive steering mechanism has so far been preferred by our designers— the greater will be the strength and bulk required of these parts, or else the greater will be the nervous strain imposed upon the driver through the jiggering of the steering lever; the alternative depending upon whether the steering mechanism operates one way only or is free to react from the ground to the driver. The evil is aggravated by sensitive steering simply because this quality necessarily means short leverage for the steering power and long leverage for the wheels.

It has several times been noted by writers on automobile subjects that the road seems rougher for one who rides in an automobile than for one who rides at the same speed in an ordinary carriage, and as the remark has been made especially with reference to the lightest pattern of automobiles, the different sensation may not be entirely due to the greater stiffness of the springs of the heavier vehicle. And in at least one case, mistake in regard to the speed was precluded through the observer's express precautions on this point. There can hardly be any doubt that the roughness is, at least in part, due to rear driving, and the importance of the matter extends beyond any mere consideration of the comfort of the occupants of the ve-

hicle, as roughness evidently implies greater force of all impacts, and therefore the necessity for greater strength and weight of all parts of the machine. The reasoning is plain. Every jolt means a check to the speed of the machine and the rotation of the front wheel, and through the momentum of the machine, tends to buckle the same up so as to bring the rear wheels closer to the front wheels than they were before. In case of front driving this tendency is minimized by the rotative energy imparted to the front wheels from the motor, which, being applied tangentially to the obstacle as before it was applied tangentially to the ground, assists the vehicle in scaling it, while the rear wheels, being idlers, follow as they may. When rear driving is a feature of the design the case looks different. The check to the rotation of the front wheel is then resisted only by the wheel's own weak rotative momentum, while the momentum of the carriage pressing from behind is reinforced by the undiminished driving energy of the rear wheels. The result must be a sensible increase in the severity of the shock.

The difference must, however, it seems, be most noticeable when driving over a road requiring a high tractive effort at slow speed, as that condition increases the energy of the driving wheels in proportion to the momentum of the vehicle; and similarly, an increase of load, as for freight automobiles, would also increase the difference between front and rear driving, but it is hardly possible to establish a comparison with tractor driving, unless the precise manner in which the tractor is hitched to the vehicle is given.

The upshot of the reasoning is plainly against rear driving as compared with any other form of driving automobiles over roads that fall short of perfection.

It need barely to be mentioned that the roughness of rear driving means also a loss of available driving power as well as increased stresses on motor parts, which must be especially serious when the motor is an internal explosion engine, with all its admitted inflexibility of the working stroke.

The internal explosion engine, when employed for traction purposes, requires a number of flexible connections between the power and the work, and the design which includes rear driving minimizes the chances for obtaining these flexible connections, throwing nearly all the burden of this requirement upon the air-tires, while at the same time rendering the practicability of these tires very questionable by loading them down with greater weight than they have been proved able to sustain.

The drawbacks to rear driving which have so far been mentioned have had no particular reference to the steering problem or to the conditions that arise when the course of the vehicle is being changed. Yet nobody will dispute that the whole set of stresses which in railroad traffic are borne by the rails and the wheel flanges and are carefully obviated by inclining the track inwardly at curves, in rear driven automobiles are thrown upon the front wheels and axle, and, through the resistance to forward motion, react upon the motor mechanism. The dangers that spring from the fact that the power acts in a direction different from the course of the vehicle until the turn is completed are many and grievous, especially in emergencies when quick turns at high speed may be imperative; and these dangers are present almost to the same extent on good roads as on bad ones.

The Universal Advantage of Communications.*

I think it may be accepted as a fact that those branches, especially of metallurgy, which have made most progress are those in which least secrecy and reserve have been practiced. No art has made such marvelous strides as the manufacture of iron and steel. Speaking from my own experience, I may say that I have never been refused admission to any iron or steel works on either side of the Atlantic, not even the works of Mr. Frederick Krupp, at Essen. But though iron masters abroad may freely throw open their doors, our own iron masters are even more liberal in communicating their plans and methods. Managers from England, smarting under American competition, who have come to this country to visit our furnaces and rolling mills, with the avowed object of borrowing their plans, have expressed to me the greatest wonder and admiration at the frankness with which they are allowed to study the great works which have demoralized prices the world over.

Not only do the iron and steel workers of every land bid their rivals enter and view the titanic feats which each vies with his neighbors in performing—they seem to take delight in telling their very secrets. Certainly no special literary organ of any art contains such frank discussion of processes and methods as the "Journal of the Iron and Steel Institute," which is not the Institute of Great Britain, as popularly supposed, but of the world. It may be inferred, therefore, with justice that the progress achieved in iron and steel making, and the delightful candor with which iron masters discuss their trials and tribulations and explain the solutions of their difficulties, are related, not accidentally, but intimately, as cause and effect.

As an example of what might be gained by interchange of experience, I may be allowed to draw an illustration from a branch of copper metallurgy. In this country and Europe there is a refining process, the operation of which some, though not all, of those who practice it, guard from inquisitive eyes with timorous care. I refer to the electrolytic process. It is understood that this is a branch of metallurgy dependent for success on the nice adjustment of a number of chemical and physical factors, and that the sixteen or eighteen works which practice it on a large scale in this country and Europe have acquired only after much trouble and serious expense the experience which enables them to turn out copper of invariable quality with almost absolute certainty. After spending time, labor and money in overcoming the difficulties which mysteriously and unexpectedly turn up, the owner of a copper refinery deems it unbusinesslike to divulge the solution of these problems, and thus place his rival's works on equal footing with his own. But, in reality, his rivals have all been battling with exactly the same foes, and most of them have been victorious. The result, therefore, of a mistaken reticence is that each of the works has had to expend, in surmounting exactly the same obstacles, six or seven times more money and energy than if all had been willing to interchange experiences. There is very little to choose between one brand of electrolytic copper and another. All are good; and all have been brought to the present high standard by separate labor and separate series of experiments, in separate establishments; whereas, had there been co-operation on points of purely technical manipulation, the same results would have been attained with an immeasurable saving of time, mental wear and tear and financial expenditure. I have used the above instance, drawn from copper metallurgy, as an illustration of the wasteful effects of secrecy, and because it stands out in such glaring contrast to the nobler practice of mutual helpfulness which has been one of the most potent forces in raising all manufacturing, but especially that of iron and steel, to the exalted position it has attained during the latter half of the century with which we are regretfully parting.

As time goes on and a generous dissemination of personal knowledge, even if it be not strictly practical, becomes the rule and not the exception, it will be discovered that, after all, success in manufacturing will depend as much on the personal energy and skill with which the knowledge is applied as on the possession of the knowledge itself.

Whether we will or not, secrecy, as a business method, is becoming almost obsolete under the prying scrutiny of the press and the telegraph. The old rules of business, dependent on reserve and on news secured in advance of one's neighbor, have given place to new methods. The chronicle of the world's doings is at the disposal of anyone for a few cents every morning of the year. But the man of business genius draws from it conclusions very different from those of his less imaginative or less enterprising rival.

*An extract from the Presidential Address, by James Douglas, LL.D., at the California meeting, 1899, of the American Institute of Mining Engineers.

Both men may possess, as stock in trade, the same facts, but the abler man makes successful use of them. His correct and far-sighted deductions lead him to adopt a policy and pursue a course of action as different from those of his sluggish competitor as if he had himself possessed special sources of information.

And so it is in the practice of our peculiar arts. The personal element determines the success of one man and the failure of another, though both start out with the same store of facts. Nevertheless, the more facts he has, the more rapid will be the rise of the man of genius, while the pace of the other will certainly not be retarded. The man of genius, therefore, need not grudge the communication of his facts to his less progressive competitor, provided he learns, in exchange, what few facts his slower neighbor may have picked up by the way. While all must admit that the world's rapid advance in material well-being has been due to the dissemination of knowledge, and that this can be effected only by the breaking down of the barriers of secrecy, some of our brethren have yet to be persuaded that there are few, if any, limitations to be set to this universal law. Unfortunately, many barricades, raised by mistaken selfishness, are still to be stormed and demolished. But the coming century will in this respect carry forward the work of the receding age, whether we shall see its accomplishment or not. At any rate, we may congratulate ourselves that societies such as ours have aided to further so good a cause, not only as media of communication, but also as sources of influence—for the most confirmed secret keeper cannot benefit by the candid revelations of his rival without some compunction; and, sooner or later, reform follows repentance. It is, therefore, not presumptuous to hope that, as the scientific temper more and more permeates the habits of our technical workers, the old fashion of relying on secrets for success will be replaced by the truer method of generous giving and thankful receptivity.

At present the world's acquisitions in pure and, to a great extent, applied science are thrown into a common stock, from which the technical worker draws what he wants without stint. He, in his turn, is coming to acknowledge and recognize the truth that it will be to his advantage to enlarge the sphere of unreserved intercommunication until there shall be no trade secrets; for then, while society will be the gainer, he himself will be able to draw from a larger capital of facts than now stands to his credit. Moreover, it may be accepted almost as a law of nature that the person who has not cultivated the habit of mental giving acquires a spirit of narrow exclusiveness which cramps the faculty of open minded receptivity—for receiving and giving are reciprocal intellectual motions.

Though the influence of individuals on the industry of the country is keenly felt, national progress, in its widest range, is not made through the impelling force of one man, be he ever so able. It results from the united efforts of many minds and many hands, acting under the contagion of a common inspiration. Looking at the development of a whole people, or of a single industry as a unit, we may therefore perceive that the old habits of secrecy in manufacturing enterprises frustrate the very object which the secret keeper aims at; for while he is guarding behind double doors his depreciated treasure the great army of progress is marching past him.

To a certain extent community of ideas and methods is secured through such combinations of capital and manufacturing interests as have become the most prominent features of modern industrial development. All the peculiar processes and methods (if there be such) practiced by each of a dozen combined mills become the property of the unified concern, and can be applied in all its establishments. But should the result of industrial combinations be the reversal of the tendency towards freer discussions, and should the managements of these tremendous aggregations of power prohibit on the part of their employees all discussion of technical subjects, a strong prejudice against their existence would be created in the public mind, which naturally distrusts all secretiveness. The public will not unreasonably conclude that if one of the great economical benefits which accrue from such combinations is the "probing" of individual secrets, much greater would be the general benefit if all reserve should disappear, and the technical facts learned by one should be communicated to all, as freely as Röntgen gave to the world his discovery of the "X" rays. Ours is stigmatized as the mercenary age. Nevertheless, there is a spirit of fraternal helpfulness abroad in the world. I believe that before long he will be honored as the most successful man who has communicated to his fellow-craftsmen the greatest number of useful facts and the largest stock of valuable personal experience; and I believe, also, that any combination of selfish men or interests which may try to withstand this rising tide of free thought and free speech will be swept away.

Legal Notes—Breakage of a Crane Hook — Responsibility for an Accident where an Employee Obeys an Order Under Protest.

While Martin Kuettman was in the employ of the Wisconsin Bridge and Iron Company he was engaged as a laborer in unloading iron from flat cars by using and operating an air hoist, which was at the time fastened to some iron bars, weighing 3,795 pounds. Kuettman and two other workmen were engaged in unloading the iron from the cars by the use of the gantry, and as the load started to rise, the air having been let on, the eye bolt broke and the hoist fell upon Kuettman, killing him instantly. J. Dietrich Spille brought suit against the Wisconsin Bridge and Iron Company as administrator of the deceased, and was awarded a judgment of $2,900 by the trial court, from which judgment the defendant appealed to the Supreme Court of Wisconsin. It appeared from the description of the gantry in evidence that there was a heavy frame structure about 80 feet in width from track to track, on which it traveled; that the top of the frame extended east and west about 80 feet; that the extreme hight of the top column was about 28 feet from the ground, and that the upper frame was about 4½ feet wide and 5 or 5½ feet deep, leaving the distance from the bottom of the frame to the ground about 22 feet. The top frame was supported by two legs on each end (being, as stated, about 80 feet apart). These legs were braced together and ran on wheels, which in turn rested on a T rail, and the gantry was moved along the track by means of pinch bars. The air hoist consisted of a cylinder with a piston head, the cylinder being hung in a perpendicular position. From the piston head was suspended a long, heavy hook, to which the load would be attached by chains, and the hoist was suspended from the carriage by means of an eye bolt about 10 inches long. Among other things, the jury found that the defendant did not use ordinary care in the selection of the material out of which the eye bolt was constructed, nor in its manufacture. The evidence showed that after the eye bolt was broken a small dark spot was discovered in the center (a little space in the center which had round edges instead of sharp edges), and that that indicated that it had been spoiled or burnt or overheated in the center, and that such defect was the result either of overheating when manufactured or that it was made of a poor piece of iron, and that the iron in the eye bolt was poorer than some of the plaintiff's experts had been in the habit of working upon. The court held that the refusal of the trial court to take the question of negligence in manufacture of the eye bolt from the jury was proper, and upon this ground the verdict of the jury would not have been disturbed, but the judgment was reversed upon other grounds, and a new trial ordered. (81 N. W. R., 397.)

The Supreme Court of Ohio recently rendered a decision in the case of Schelies against Van Duzen Gas and Gasoline Company.

It appeared that while the plaintiff was in the employ of the defendant as a machinist, Emil Bul, the foreman of the defendant, peremptorily ordered Schelies to adjust the shafting of a portable gasoline engine which connected with a pump and

circular saw by means of belting. The plaintiff suggested that it was not safe to adjust the shafting close to the saw without stopping the machinery first, but the foreman repeated his order, and the plaintiff obeyed. His clothing was caught by the saw and he was seriously injured. He brought suit against the company, claiming that they were negligent in not providing a fender or shield for the circular saw, and in not stopping the machinery while plaintiff was engaged in fixing it. The defendant contended that the servant assumed the risks incident to the business, that this risk was incident to his employment, that he was guilty of contributory negligence and that he therefore could not recover.

The jury rendered a verdict in favor of the plaintiff and the defendant appealed.

The Supreme Court, in affirming the judgment of the trial court for the plaintiff, after explaining that this case did not fall under the general rule as to the assumption of risks by the plaintiff, incident to his employment, said: "The law remembers that the respective situations of the master and servant are unequal, and excuses the servant for deferring to the superior judgment of the master. If, therefore, the master orders the servant into a situation of danger and he obeys, and is thereby injured, the law will not deny him a remedy against the master on the ground of contributory negligence, unless the danger was so glaring that no prudent man would have entered into it, even when, like the servant, he was not free to choose." (55 N. E. R., 998.)

W. M. SEABURY.

43 Cedar street, New York.

Tools to be Purchased by the Navy Department.

It is reported from Washington that tool builders may soon expect another large order from the Navy Department. The Deficiency Bill that recently passed Congress carried an appropriation of about $2,500,000 for the Bureau of Construction and Repair, and as only four months of the official year remain in which to spend it, Admiral Hichborn is reported to have instructed his representatives at the several navy yards to prepare their list of tools as soon as possible in order that contracts may be made for them in time to meet the payment from the deficiency appropriation. The absence of the large ships from the navy yards, and the presence of so many of them in Philippine waters, makes it impossible to spend all the appropriation on repair work between now and the first of July; and as Admiral Hichborn believes that the purpose of Congress in appropriating money is that it should be spent, his action will meet the hearty approval of tool builders throughout the country. It is not probable that advertisements will be issued for these tools, but they will be purchased in the usual manner through the navy purchasing officers.

Not Consulting Engineer for the Tripler Company.

Editor American Machinist:

I have noticed in the daily papers many advertisements of liquid air. I have been consulted by the organizers of The Tripler Liquid Air Company concerning the application of liquid air to the manufacture of explosives, and at their request wrote them a letter on the subject; but other than that I have not been consulted, and I am in no way responsible for the claims for liquid air which are now being advertised. Very respectfully,

HUDSON MAXIM.

891 Sterling Place, Brooklyn, March 1, 1900.

Pay Employees for Suggestions.

The Cleveland (Ohio) Twist Drill Company has introduced in its factory the system of awarding, semi-annually, prizes for valuable suggestions made by employees. A printed notice to employees has been issued, in which such suggestions relating to the business are invited. Prizes are to be awarded as follows: First prize, $50; second, $20; third and fourth, $10 each; fifth and sixth, $5 each. The company writes us that the employees have taken hold of the idea with a great deal of vim and enthusiasm and that it is believed the results will be gratifying.

Mechanical Draftsman.

The Municipal Civil Service Commission of New York city will hold an examination for the position of mechanical draftsman on Monday, March 12. Candidates will be examined in technical knowledge, experience, mathematics and handwriting. The technical paper will call for a knowledge of iron and steel construction and structural work in general, with particular reference to bridge construction. Candidates, who must be residents of the State of New York, should provide themselves at the time of the examination with drawing materials, with the exception of paper.

For further details with reference to the subjects of the examination application should be made to F. G. Ireland, chief examiner. Application blanks and general information may be obtained by addressing Lee Phillips, Secretary, New Criminal Court Building, New York.

Proposed Commercial Legislation.

Representative Fitzgerald, of Massachusetts, has introduced in Congress a resolution calling for the appointment by the President of a commision of five persons to investigate the trade and commercial relations of this country with other countries, with the view to the establishment of a national commercial university at Washington. Congress has been asked to appropriate $200,000 to enable the Philadelphia Commercial Museum to increase its facilities for supplying commercial information to chambers of commerce and other trade organizations throughout the country. The Commercial Museum is a deserving institution and has done much toward popularizing American goods in various countries. Other grist in the national legislative mill includes bills to reorganize the consular service, to establish a department of commerce and industries, to establish the metric standards of weights and measures, to incorporate the National Association of Manufacturers, for the purpose of giving additional stability to that organization, and to appoint a commission of industrial experts to study trade conditions in the Orient with a view of increasing American trade in that part of the world. A. F. T.

Personal.

K. E. Voorhes has resigned his position with the New York Shipbuilding Company, and is now with the Sharon Steel Company.

James Hartness, manager of the Jones & Lamson Machine Company, sailed for Europe on the "Teutonic" February 28. His trip will occupy two or three months and is for both business and pleasure. Mrs. Hartness accompanies him.

Gilbert Wright, for the past five years designing engineer of the detail department, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., has been appointed chief draftsman at the Newark (N. J.) plant of the Westinghouse company.

John Fredette, for six years in charge of the tool-room of the McKay Shoe Machinery Company, Winchester, Mass., has taken a position as tool designer of the detail department, Westinghouse Electric and Manufacturing Company, of East Pittsburgh, replacing D. E. MacCarthy, who has been assigned to the mechanical engineering department of the same company.

Obituary.

H. D. Richards, of Binghamton, N. Y., died there recently of typhoid fever. He was general foreman of the machine shop of the Bundy Manufacturing Company, and assisted us in the subscription department. At the time of his death he was thirty-seven years old.

William E. Ward, president of the Port Chester (New York) Bolt and Nut Company, and also of the firm of Russell, Byrdsall & Ward, Port Chester, died March 2, seventy-nine years old. Mr. Ward was a native of Indiana, and a member of the Society of Friends. He began the manufacture of wood screws at Port Chester in 1845, and the business

rapidly grew with the aid of his numerous inventions, until now more than 1,000 men are employed. Mr. Ward had been a member of the American Society of Mechanical Engineers since the first year of its organization.

The Cost of Materials and Labor.

A concern located in Pennsylvania recently made the following detailed statement of the increased cost of materials entering into their line of manufacture. They make vises, machinists' and plumbers' tools, etc., and their statement is as follows:

"The following percentages show the actual increase in costs of raw materials which enter largely into the manufacture of our lines, over prices current in the spring of 1899: Pig iron, 125 per cent.; steel, 100 per cent.; copper, 81 per cent.; tin plate, 76 per cent.; wire, 132 per cent.; nails, 170 per cent.; lumber, 87 per cent.; bolts, 111 per cent.; asbestos, 31 per cent.; pipe, 184 per cent.; pipe fittings, 111 per cent.; rivets, 110 per cent.; oils, 100 per cent."

As nearly as we can judge, the rate of wages paid for labor has advanced about 10 per cent., although this of course does not mean that labor costs have advanced in the same proportion, because the work of increasing labor's efficiency has been going on continually, and we think it perfectly safe to say that the labor cost of most lines of machinery has been reduced at least 10 per cent. annually for several years past; we mean, of course, in those shops that have been under the influence of modern progress and have kept themselves up to date.

New Catalogs.

The Northern Engineering Works send a copy of their catalog No. 102, showing their tandem gas and gasoline engines. In the pamphlet are listed engines of 10 to 60 actual horse-power, with their weights, speeds, etc. It is of standard size, 6x9 inches.

"Many Expressions of Opinion" is a testimonial booklet issued by the Carborundum Company, Niagara Falls, N. Y. It is illustrated with vignettes appropriate to the products of various lines of manufacture in which carborundum has been used. Size, 3¼x6¼ inches.

We have received from L. S. Heald & Son, Barre, Mass., a catalog of the "American" twist drill grinder manufactured by them. The machine is shown in several styles, and its points are explained in some detail with the help of line drawings. The pamphlet is of standard size, 6x9 inches.

The Merwalk Metallic Gasket Company (factory, South Bethlehem, Pa.) has issued a little pamphlet in which its gaskets are described with the aid of line drawings. There is a price list of sizes carried in stock, adapted to pipes from 2 to 48 inches diameter. The catalog is 3½x6 inches in size.

The C & C Electric Company has issued two new bulletins. No. 131 relates to some motors and dynamos which have not been treated in separate bulletins, including certain of the "P. P.," "I. C." and "T. B." types.

(Continued on page 46.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 20.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Corliss engines designed. Box 183, AM. M.

Rawhide, fibre and hard rubber gears. The Arthur Co. (See page 53.)

Metal novelties, we buy and manufacture. Bliss Metal Co., Providence, R. I.

Will buy or pay royalty for good patented machine or tool. Box 228, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Models, patterns, drawings and light machinery. Ashland Tool Works, Ashland, Pa.

80 H.-P. boiler for sale, good condition. Delaware Hard Fibre Co., Wilmington, Del.

Book "Dies & Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Best of facilities for medium heavy work; contracts taken. Blanchard Mach.Co., Boston.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

For Sale—Patterns for 25 machines; goodwill 25 years' standing. F. Gleason, American & Susquehanna ave., Philadelphia, Pa.

For Sale—Two geared Ferracute presses, 62 in. between uprights; little used, and in good condition. Address W. H. Mullins, Salem, Ohio.

Correspondence desired with firms wishing Chicago representative, by a young engineer having good office and large acquaintance. Address M. E., care AMERICAN MACHINIST.

Correspondence solicited with manufacturers of engines or other machinery, who wish to improve their designs or methods and desire skilled assistance. Box 214, AM. MACH.

Wanted—A fifty (50) horse-power second hand engine in good repair, a Westinghouse compound preferred; advise at once your best cash price. The Rogers & Hubbard Co., Middletown, Conn.

Wanted—Good second-hand power shears; rotary cutters preferred; cut up to ¼ inch thick; up to 18 in. wide; any ordinary length; make, condition and terms. Address "Shears," care AMERICAN MACHINIST.

Opportunity.—Proprietor of machine shop in Eastern Pennsylvania desires partner; building special line of machine tools; business well established and growing; about $15,000 required. Box 238, AMER. MACH.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

An active, first-class typewriter company, manufacturing a high-priced machine, having outgrown its plant and factilities, desires to negotiate for the building of its typewriters under contract, with a prominent firm or corporation manufacturing goods of conspicuous merit. Address Box 231, AMER. MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Machinist—Young man wishes position in mechanical drawing room, having had two years' experience. Box 239, AMER. MACH.

Wanted—Position as foreman pattern-maker; 20 years' experience; 8 years foreman; best of references. Box 220, AM. MACH.

Change wanted by the mechanical superintendent of a large works; age 33; 8 years in present position; best record and references. Address Box 234 AMERICAN MACHINIST.

Mechanical draftsman, speaking English, French, German, 10 years' practice in America, wants position with exhibitor at Paris Exposition. Box 221, AMERICAN MACHINIST.

Young man (30) seeks position as foreman, or where large experience with modern shop practice and tools, especially heavy turret lathes, would be of value. Box 235, AMERICAN MACHINIST.

Practical foreman patternmaker desires situation; experienced in patterns for loam, green and dry sand castings; 15 years' experience; good testimonials; strictly sober. Box 236, AMERICAN MACHINIST.

Power plant engineer and manager of very large experience, having built some of the largest plants in the United States, is open for engagement; well up in the design, construction and operation of both mechanical and electrical plants; will go anywhere for permanent position at reasonable salary. "Hustler," care AMERICAN MACHINIST.

Help Wanted.

Twenty first-class machinists wanted; steady work. Address Weber Gas & Gasoline Engine Co., Kansas City, Mo.

Wanted—Man to take charge of office and estimate department in large engine works. Box 233, AMERICAN MACHINIST.

An opening for good salesman or machinist having a few hundred dollars and a clean record. Address "Bayidon," AMER. MACH.

Wanted—Draftsman accustomed to stationary engine work; steady employment and good wages. Box 232, AMERICAN MACHINIST.

Draftsman wanted; young man with ideas, to begin on a modest basis with a growing shop. Brandywine Machine Works, Wilmington, Del.

Wanted—General machine shop foreman, up to date, with experience on steam and gas engine work, and good references. Address Box 237, AMERICAN MACHINIST.

Wanted—A man with executive ability to superintend a brass foundry making large and small castings; must be up to date. Address "President," care AMERICAN MACHINIST.

Wanted—First-class field foreman, competent to erect stand-pipes, pen-stocks, steel stacks, etc.; state wages and references. Address "Field Foreman," care AMER. MACH.

Wanted—First-class planer hand on small machinery and tools; give experience, age and wages expected; works situated in Worcester Co., Mass. Address "Planer," AMER. MACH.

Wanted—Foreman who understands construction of stamping presses and sheet-metal working tools; must be competent and able to handle men. Address C. N. A., AMER. MACH.

Wanted—Foreman to take charge of die department; one thoroughly experienced in stamping dies, able to handle men, and not over 35. Address C. N. A., AMER. MACHINIST.

A number of toolmakers and skilled machinists wanted, also several foremen in our machine department at our shops, Marion, Jersey City, N. J. Automobile Company of America.

Wanted—A machine shop foreman who is familiar with machine tool building; must be able to handle 50 men to advantage; one who can furnish the best of references as to ability. Box 227, AMERICAN MACHINIST.

Wanted—An experienced chief draftsman upon brass rolling mill machinery; must be a good machine designer and able to manage a large force of draftsmen; state age, experience and salary required. "Z.," AM. MACH.

Wanted—Three or four good molders for machinery castings; standard wages and steady job offered to good, sober, industrious mechanics; state experience, age, and give references. Apply or address Kenney & Co., Scottdale, Pa.

Wanted—A first-class machinist who is familiar with turning large shafting; none but first-class men of good habits and energy need apply. Address "Shafting," care AMERICAN MACHINIST, stating experience, wages required, age, etc.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—First-class men on boring mills, planers and lathes, and toolmakers, accustomed to making punching dies for electrical work, to send for application blank and register with us. Bullock Electric Manufacturing Co., Cincinnati, Ohio.

(Continued on page 46.)

No. 132 pertains to four-pole dynamos and motors, "F. P." type, and embraces floor, wall and ceiling patterns. Each bulletin is 5x8 inches.

The Bullock Electric Manufacturing Company, Cincinnati, O., sends us "Bulletin No. 32A," which supersedes No. 32, and is devoted to direct-current multipolar motors, type "H," belted. Their construction is explained, and a table of dimensions of motors from 7 to 440 horse-power is given, also lists of sizes of slow and moderate-speed motors. The catalog is of standard size, 6x9 inches.

The Colliery Engineer Company, proprietor of the International Correspondence Schools, Scranton, Pa., sends us a copy of the catalog of its school of mechanical engineering. This embraces courses of study in mechanical enginering, mechanical drawing, gas engines, refrigeration and farm machinery. Methods of instruction, instructors, subjects, etc., are described copiously. The pamphlet is of the standard catalog size, 6x9 inches.

The Erie Pump & Engine Company (successor to Davis-Farrar Company), Erie, Pa., sends a catalog of its centrifugal pumping machinery. Some specialties of the company are ash pumps, ballast pumps, circulating pumps, drainage and irrigating pumps, stock, pulp and half-stuff pumps, lead-lined and bronze pumps for sulphite mills, tannery pumps of brass, belted or with engine direct; wrecking pumps and dredging pumps. Size of catalog, 9¼x6 inches.

We have received from the Rawson & Morrison Manufacturing Company, 31 to 45 Main street, Cambridgeport (Boston), Mass., a copy of their large-edition catalog "C," of hoisting machinery. In it are illustrated and described steam hoists of many patterns and adapted to a great variety of purposes, including mining, logging and marine work. There are hoisting engines with and without boilers, and several forms of boilers are shown separately. The book is 12x9 inches.

The D. E. Whiton Machine Company, New London, Conn., sends us a descriptive circular of moderate-priced gear-cutting machines, with cutters and other accessories and a few of their lathe chucks. Among its features is a new improved power feed or semi-automatic gear-cutting machine, capacity 30 inches diameter, 6¾-inch face, 5 diametrical pitch. There are new cuts of the center attachment, vise attachment and arbor support. This catalog is of standard size, 6x9 inches.

We have received from the Watts-Campbell Company, Newark, N. J., a catalog describing improved Corliss steam engines built by them. The features of these engines are explained in some detail, and are illustrated by line drawings as well as general perspective views. Several pages are occupied by an extract from the "American Machinist," October 29, 1887, with illustrations. It describes some tandem compound condensing Watts-Campbell engines installed at the Shrewsbury Mills, East Newark, N. J., and gives the results of tests there made. The size of the catalog is 7x10 inches.

We have received from the American Clayworking Machinery Company, Bucyrus, O., a catalog of their varied line of machinery and other apparatus for brick-making, tile-making, sewer pipe and roofing tile manufacture, terra-cotta working, clay refining, etc. The company's products extend to kilns, cars, barrows, elevating, conveying and power-transmitting machinery, and they seem to be prepared to furnish complete equipments for any branch of structural ceramics. The illustrated descriptive catalog is 10½x7 inches, and is accompanied by a 64-page price list, 4x6½ inches.

"A New Industrial Situation" is the title of a special pamphlet published by the West-

(*Continued on page* 47.)

Help Wanted—Continued.

Wanted—Several good machinists for a machine shop building engines and doing general jobbing, repair, etc.; we prefer mechanics between the ages of 28 and 45; state experience, age, and give references. Apply or address Kenney & Co., Scottdale, Pa.

Wanted—First-class layer-out for boiler shop, capable of laying out plates for all kinds of boilers, tanks and general jobbing products; must be sober, reliable and capable of working from blueprints, without other instruction. Address, stating age, salary wanted and present employer, "Layer-out," care AMERICAN MACHINIST.

Wanted—Foreman for machine shop (200 men); first-class, aggressive, theoretical and practical mechanic, possessing complete knowledge in designing and constructing tools and fixtures; having good executive ability and thoroughly experienced on up-to-date piece-work system. Apply, stating salary expected and giving references, "Foreman," care Samuel Houston & Co., 56 Wall st., New York City.

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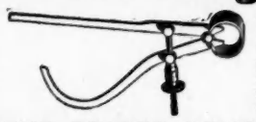

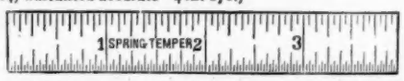

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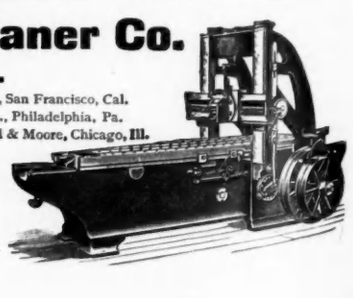
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